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### ELECTRICAL POTENTIAL AND ENERGY.

In another column will be found an interesting letter from Prof. Waddell in reply to a criticism on a recent article from his pen by Mr. A. W. K. Peirce. The mechanical analogy to which the criticism refers is an instructive one, if, of course, it correctly represents the facts. The remarks of Mr. Peirce are perfectly just, as stated, but according to Prof. Waddell they do not apply to the case in point. As an illustration he takes the case of a conductor moving across a field of varying intensity; on account of the different rates of cutting lines of force, the potential at different points in the wire will not be the same, and, therefore, a current will be set up even if the conductor is, for example, a straight piece of wire. Though this point has often been discussed before, it is an interesting one and we shall be pleased to hear from others on it.

### CONSUMPTION OF ARC CARBONS.

In another column Mr. Alfred H. Bucherer discusses the explanation recently advanced by Drs. Bedell and Crehore in regard to the cause of unequal consumption of the two carbons of an alternating current lamp. Mr. Bucherer first explains the higher temperature of the positive carbon of a continuous current arc as due to an electro-chemical action similar to that of the Peltier effect. He believes also that the action between the poles of arc carbons is analagous with that between the electrodes of a galvanic cell, there being in both cases a transfer by ions or atoms. I twould seem that the higher temperature of the crater of a continuous current arc can be suexplained by reference to the lesser loss of heat from it by radiation on account of its position. In any event, its temperature with a given carbon in a constant, being that of the temperature of carbon vaporization, and it appears to be merely a question of radiation why the positive carbon has a larger area at this temperature than the negative one. Even if the negative carbon were cooled by the action referred to, and the positive carbon further heated, their temperatures would depend upon a relation between the supply of heat and the radiation. As the maximum temperature is fixed, conditions may be imagined where the temperatures would be the same regardless of a greater supply of heat to the negative carbon. It, therefore, seems not to be necessary to explain the difference in temperature of the carbons by any other action than that of radiation.

### SUBWAYS FOR ELECTRICAL CONDUCTORS.

The suggestion of Mr. Alfred R. Ledoux, reprinted elsewhere from the *Evening Post* that provision be made for electrical conductors in the underground structure of the New York City rapid transit railways is an excellent one. In some of the plans of underground construction proposed, this could very conveniently be done at a moderate expense, and even if the expense were considerable it would nevertheless be justifiable in view of the present condition of affairs in respect to the control of the electrical subways now installed under the streets of New York. The subway system in this city was unblushingly devised in the interest of corrupt politicians and its administration throughout has been little short of a scandal. The recent Berliner patent decision will again direct attention to one of its abuses, since the control which the Metropolitan Telephone Company has been permitted to acquire in the subways, in effect renders permanent a monopoly that otherwise would have been brought within the field of competition by the expiration of the life of the telephone patents. With the control that this company now has over the subways of New York City, the recent annulment of the Berliner patent was really a matter of minor moment, for how can there be competition, even with every detail in the art of telephony free of patents, if, as is thought by many well informed people, the local telephone company has, through the devious

subway laws, so arranged matters that its competitors cannot install under commercial conditions, the necessary lines? It remains to be demonstrated, however, whether this control is as absolute as is generally supposed, and a prospective competitor would confer a favor on the public and achieve a popularity that, in the event of success, would have a commercial value, by testing the matter in the courts or soliciting the intervention of the legislative power. The municipality is supposed to have the right to take over these subways at some future time, and no time is more propitious than the present to determine if the right is an absolute one, and, if so, to exercise it without delay. In any event advantage should be taken of the building of the rapid transit road to provide for a more comprehensive system of installing electrical conductors than the present one.

### THE TELEPHONE SITUATION.

We print elsewhere a budget of matter bearing on the telephone situation which enables it to be viewed from several different standpoints. As will be seen by reference to the opinion of Judge Carpenter, it was decided that the Berliner patent of 1891 comes under the recent decision of the Supreme Court to the effect that a patent is invalid when its subject matter has been disclosed in a previous patent, and which has also claims, though differing in breadth, pertaining to the same features. In the present instance the Court maintained that both the function and the device for effecting the function, are identical in the 1880 and 1891 Berliner patents, and the latter is therefore void. The importance of this point is that if the case comes upon appeal there is offered for consideration, besides the issue of unlawful delay, a point in regard to which the view that will be taken is not uncertain. Some misconception seems to exist in regard to the bearing of the Bate Refrigerator case on the situation, the newspaper comments in connection with the Berliner decision in particular being much at fault in this respect. It is true that a reversal of the present interpretation of the famous statute, 4,887, would revive the Blake and Edison telephone patents, but it is none the less true that these patents are now dead and the inventions to which they refer are public property, free to all. Owing to the circumstances, there seems to be no probability in case these patents are thus revived, that the court would order any accounting of profits. As we have stated before in these columns, it is generally thought by those competent to judge, that the Bate Refrigerator case was carried to the Supreme Court as a forlorn hope, and that the probability of a reversal through it of the present interpretation of section 4,887 of the revised statutes, is exceedingly remote. Assuming, however, that the law involved is reversed, the patents thus revived would not have the presumption of validity in their favor that existed in their favor formerly on account of the principle above referred to, recently laid down by the Supreme Court. The patents would have to be judged by this new criterion, with a probability that neither the Edison nor Blake would stand the test. By reference to the detailed examination of the situation, in another column, it will be seen that at present all forms of telephone receivers and transmitters are free, and on January 15, the valuable patent on the use of the induction coil with the transmitter will expire. As a consequence, private lines may be installed and operated under the most advantageous circumstances. The situation as to large exchange stations, however, is still much involved, and owing to the multiplicity of patents concerned and the scant knowledge on the subject of the requirements of exchanges outside of the Bell Companies, it will be some time before it can be cleared up. It now seems that there would be much difficulty in economically operating any exchange of considerable size without the aid of switchboard and other devices covered by Bell patents. When, however, the difficulties to be overcome are clearly defined and understood, the matter will come within the province of the inventor, and the conditions would have to be singular indeed if some method of meeting them could not be eventually be devised. But if this should this be done, it does not follow that competition with the present local telephone companies would be a simple matter. Their prior occupation of the field, the sagacious preparations, extending over a course of years, that were made with a view to prospective competition, united with a highly trained and efficient force, and exchanges in which the subject of economy of operation has been most exhaustively considered—all of this renders successful competition a question that cannot be taken for granted.

### The American Institute of Electrical Engineers.

At the ninety-second meeting of the American Institute of Electrical Engineers, held at 12 West Thirty-first Street, December 19, a paper by Mr. Ludwig Gutmann "On the Production of Rotary Magnetic Fields by a Single Alternating Current" was read by Dr. Pupin.

The principle of the motor described in the paper consists in the division of a closed circuit armature winding into sub-circuits, greater in number than the number of motor poles, that is, in the two-pole motor, the closed armature winding may be connected at three points 120° a part—the connecting wire leading from 0° to a point of the armature winding 120° away, then from 120° to 240° and finally from 240° to 0° again. Each of the sub-circuits thus consists of one-third of the armature winding and a wire joining the extremities of this third, each of the three connecting points on the armature wire being common to the two adjacent sub-circuits.

The result of this system of connections is that a motor has more than one synchronous speed; the greater the number of sub-circuits, the greater the number of speeds at which the armature can operate. If the armature contains ten closed circuits, and rotates in a two-pole field, it will be able to generate five currents, lagging 72 degrees behind one another in phase, and would have at least five speeds which are synchronous.

Looking at the device from a general standpoint, the author states that this particular armature construction embodies all the weak points of a synchronous and all the strong points of the polyphase motor. The weak points are, first, that the machine will not start from state of rest in the form described, the coils act on one another differentially and have a variable and negative value; they are in magnetic stability when at rest, hence, no rotation can result; second, the device has a small starting torque when rotated, owing to the differential action of the coils, which cause, with a small number of closed circuits, strongly oscillating or jumping poles, until a harmonic speed is reached; third, the device, when in rotation, is not reversible by simply changing circuit connections.

The strong points claimed are, first, that the motor develops polyphased currents in its own windings; second, that therefore it is more difficult to pull it out of step as it has the capacity to stand, what I would term, magnetic slippage.

The device can be made to become self-starting as a series, a shunt or an induction motor in a field of single phase or polyphased alternating currents. Suppose we have two simple continuous current motors with their armatures on the same shaft, and with both armature windings connected electrically by four wires at points of equal distance along the circumference, which number of conductors may be reduced or increased, depending on the number of phase currents desired. Now, if we send an alternating current into one of the series motors, then the armature will start from state of rest and will send current impulses into the second armature, which become the more regular the more the armature has approached synchronous speed, where bi-phase currents will be established therein; these react on the field magnet core of the second motor, and for the purpose of maintaining the armature in this synchronous speed, the commutator of the second motor is applied to rectify the polyphase currents, and the resulting continuous current may be used to energize the magnet of this motor.

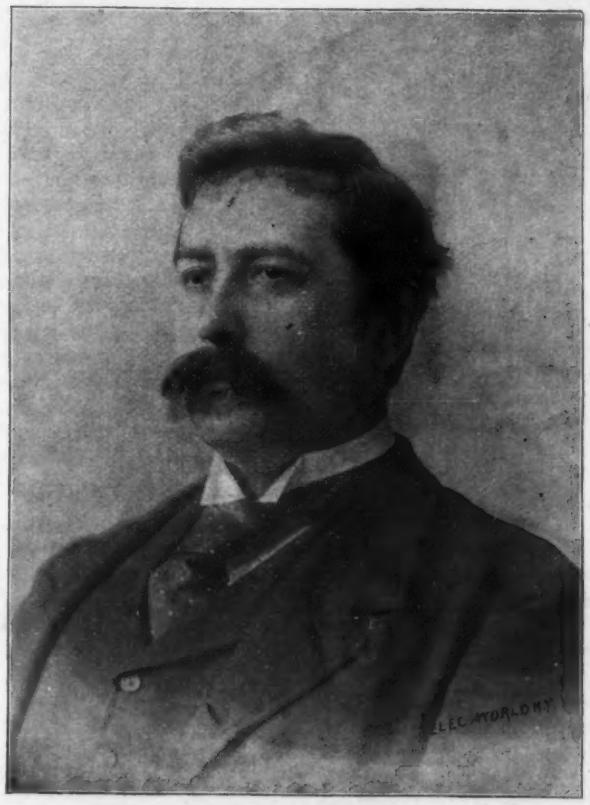
### Rotary Field Motors.

In an editorial in our last issue under the above caption, by a slip of the pen the word "self-induction" was used instead of "reactance" in referring to Dr. Pupin's discussion of Lieut. Reber's paper. The phrase in question should read "The difference in phase in induction motors is produced by the *reactance*, which is greatest when the armature is at rest."

## Gisbert Kapp.

Those who occupy themselves entirely with pure theory and science are often looked upon by the mechanic or constructor, as impractical, and their teachings are, as a rule, beyond the reach of those whose occupation is to produce industrial commodities. On the other hand, the scientist generally leaves the application of his discoveries entirely to the mechanic or constructor, as he too often considers this beneath his dignity. The natural result is that there often exists an unfortunate gap between the two classes of workers. Fortunately, however, there is another class consisting of highly educated engineers who are capable of understanding and appreciating pure science while at the same time they are eminently practical, and it is these who fill the gap between the two, thereby bringing the valuable results obtained by the scientific investigator well within the reach of the mechanic or producer of commodities.

The science and industry of electricity is fortunate in having among its workers a number of men of this class, and one of the most eminent of them is Mr. Gisbert Kapp. His education has been such that he is quite capable of comprehending the researches in pure science, and on the other hand his occupation has been chiefly that of a practical engineer and constructor, thus enabling him to apply in practice the best of existing knowledge. The results which he has accomplished show both a thorough knowledge of the principles, as well as a capability of applying them to the best advantage in practice. He was one of the first to develop a theoretical discussion of the dynamo which was of real practical value to the constructor, and his well known papers, in which he first published it, have become almost classical, and even to-day many of the principles brought out by him at an early date are still in constant use by dynamo designers and constructors. His papers and books on the one hand and his types of dynamos and alternators on the other, show the possession of the qualities as scientific investigator and of the constructing engineer which together make the ideal combination that is the object of modern engineering education, though rarely attained.



GISBERT KAPP.

Mr. Kapp was born at Mauer, near Vienna, in the year 1852, but although an Austrian by birth his principal work in the electrical field was done while in London. He was educated at the Polytechic school in Zurich as a mechanical engineer and devoted himself in the earlier part of his career more especially to marine, hydraulic and steam engineering. He was for five years chief draughtsman and designer to Messrs. Gwynne & Company, of London, and during that time he designed the machinery for a large number of pumping stations for drainage works in Holland and for docks in England and the Colonies. This work, curiously enough, was also intimately connected with the gas interest, since the firm of Gwynne & Company was largely employed in the manufacture and creation of direct driven gas exhausters, in connection with which he introduced several improvements.

After leaving Messrs. Gwynne & Company, Mr. Kapp travelled for two years on the Continent and in North Africa on behalf of the agricultural implement firm of Hirnsby & Sons, Ltd., in order to introduce their machinery and establish agencies, but this field of commercial activity did not satisfy his mechanical taste and when in 1882 the electric lighting industry began to take root in England he accepted an appointment as manager at the works of Messrs. Crompton & Company in Chelmesford. One of the first results of this appointment was his invention of compound winding and although it was subsequently shown that the same invention had been made by Varley some years previous, the principle of compounding as carried out practically by Kapp secured something akin to a monopoly to the Chelmesford firm, which lasted until other firms had succeeded by experiment in arriving at the same result.

In the following year Mr. Kapp invented a class of electrical measuring instruments in which permanency of calibration was obtained by the use of over saturated electromagnets. These instruments were known under the name of current or potential indicators and were widely used at that time. They had, however, the drawback of being influenced by external magnetic fields and were long ago superceded by others.

In the year 1885 Mr. Kapp severed his connection with Messrs. Crompton & Company and established himself as a consulting engineer in London. About the same time he developed his well known theory of the dynamo which appeared in the form of papers read before the Institution of Civil Engineers and the Institution of Electrical Engineers, and was one of the first, if not the first, that was of any real value. This theory, and the practical part of the subject, formed the subject of his well known book on "The Electric Transformation of Energy," which appeared in 1886 and has been translated into French and German. A fourth edition of this book appeared in September of the present year. In 1886 Mr. Kapp accepted an appointment as London editor of the journal "*Industries*," which was started at that time, and he occupied the editorial chair for three years until his growing practice as a consulting engineer employed his time to such an extent as to compel him to give up journalistic work.

Mr. Kapp was an early advocate of the advantages of alternating currents for central station work, and he devoted considerable attention to the scientific construction of alternators, transformers and accessory apparatus. The alternator designed by him and known under his name was taken up first by the Oerlikon Electrical Engineering Works in Switzerland and then also by Messrs. Johnson & Phillips in England, and very many of these machines are still in use in Europe.

Last year Mr. Kapp brought out a new type of alternator in which the armature winding is stationary and the coils are so arranged as to be capable of being quickly removed and replaced in case of damage. This type of machine has also been taken up by the two firms above mentioned.

Although Mr. Kapp made many friends in England and had there a very extensive practice as consulting engineer, he has recently left that country and settled in Germany. The cause of this step was the health of his wife, who suffered on account of the English climate. As the physician prescribed for her a change to the more bracing climate of the Continent, Mr. Kapp accepted an offer made him by the Verband Deutscher Elektrotechniker to become its general secretary, and take the editorship of the *Elektro-technische Zeitschirft* with headquarters at Berlin, which position he now holds.

Mr. Kapp's charming personal qualities compel the admiration and respect of all who meet him. His modest, unassuming and cordial manner, combined with his high standing as an engineer, have made him many friends and admirers, as was shown by the universal regret expressed by his colleagues when he left London some months ago and by the testimonial tendered him on that occasion.

Mr. Kapp is a member of the Institution of Electrical Engineers and of the Institution of Civil Engineers, to both of which societies he has presented a number of very valuable papers. He has also been a frequent contributor to the English technical press and has written various works on dynamo electric apparatus, most of which have a world-wide reputation. Recently he has been admitted as a lecturer at the Polytechnic Institute in Berlin, where the lectures on the electromagnetic apparatus, which he is now giving, are highly appreciated.

## Judge Carpenter's Opinion in the Berliner Case.

In last week's issue we referred editorially to the important decision of the United States Circuit Court for the District of Massachusetts, in the suit of the United States vs. the American Bell Telephone Company, for the repeal of the Berliner patent of November 17, 1891. In Judge Carpenter's opinion the first point taken up is the identity of the functions of the device described in the patent in suit with those shown in the Berliner patent of November 2, 1880. After discussing the facts at issue Judge Carpenter conclude, that since one of the functions shown in the patent of 1880, namely, the function of transmitting articulate speech, is identical with the sole object or function covered by the patent of 1891, and since the device for effecting the transmission is identical in both patents, the patent in suit is void under the principle laid down by the United States Supreme Court in the case of the Miller vs. Eagle Manufacturing Company, commented upon in THE ELECTRICAL WORLD of February 17, 1894.

The other point involved was that the issue of the patent in suit was unlawfully delayed through the fault of the respondents. The Court relates that the application for the patent was filed June 4, 1877, and the patent was issued November 17, 1891. The patent to Bell expired in March, 1893. The device covered by the patent in suit had been in public use by the respondent corporation since the year 1878. The respondent corporation was of ample means to prosecute the application. The result of any delay which might take place in the issue of the Berliner patent would evidently be to continue so much longer the practical monopoly of the art of electrical transmission of articulate speech. Under these circumstances, the court thinks it clear that the duty of the respon ent corporation was to use the greatest degree of diligence in prosecuting the application to an early issue. There should have been, at least, as great diligence as their own interests would have called for, had their business been unprotected by patent rights.

In examining the question of diligence the court finds that up to June 9, 1882, there is no allegation of delay in prosecuting the application, but from that date to 1888 the issue of the patent was unwarrantably delayed on the plea of expected interference, and there was set on foot a so-called "general understanding" on the part of the patent office examiner and the respective counsel for the Bell Company and for Drawbaugh, with whose application an interference was unwarrantably anticipated; in acquiescing to this understanding the court holds that the Bell Company failed to do its duty and committed a wrong against the public. The plain duty of the Bell Company, it states, was to insist on its right to a patent at once, leaving the question which was pending in the courts to be settled whenever a final decision should be reached, and leaving the decision of that case to have whatever effect it lawfully might on the validity of the patent.

The court is of the opinion that the unwarrantable delay thus caused was intended by the Bell Company, and cannot doubt but that, in matters of this consequence, involving the whole business of a company of so large a capital and engaged in so large affairs, it was fully advised as to the facts and the law; its acts, therefore, were so gross as to forbid any inference except that it dishonestly delayed the issue of the patent, taking advantage for that purpose of the perhaps excusable willingness of the officials of the Patent Office to postpone the decision of a sharply debated question, in which a large public interest was involved, on the chance that a decision of the Supreme Court might supersede the necessity for a decision on their part.

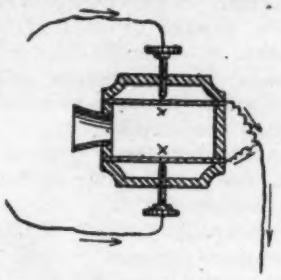
As to the delay after 1888, the court relates that the Drawbaugh claims were decided by the United States Supreme Court to be unfounded in March, 1888, and a proceeding was then set on foot by the Commissioner of Patents to determine if there had been a public use of Drawbaugh's invention for two years before the date of his application; the Berliner application was then again suspended to await the result of this investigation (which was strenuously objected to by Drawbaugh, who took no part in it), and upon a final decision in October, that there had been no such public use, the Berliner patent was ordered to issue.

The court, after examining the facts bearing, is persuaded that the delay, both previous and subsequent to 1888, was intentionally acquiesced in by the Bell Company for the purpose of delaying the issue of the patent. In regards to the proof offered as to the urgent solicitation by the Bell Company for prompt action, the court intimates that this solicitation was only for effect, and concludes that the real policy was that the application was to be "worked along quietly" although apparently pushed with great energy.

The decision rendered is that the complainant has made out the case and that there should be a decree that the patent in question is void and shall be delivered up to be cancelled.

## The Telephone Patent Situation.

Although the Berliner patent claims were of a broad and fundamental nature, and although the decision of Judge Carpenter will be far-reaching in its effects and will open wide the field for telephonic competition, yet it must not be supposed that the practice of the art of telephony has in its entirety been made free by this most popular decision. Aside from its magnificent plant and the present possession of the field, the American Bell Telephone Company still possesses numerous broad and strongly drawn patents controlling many features which have been found most desirable



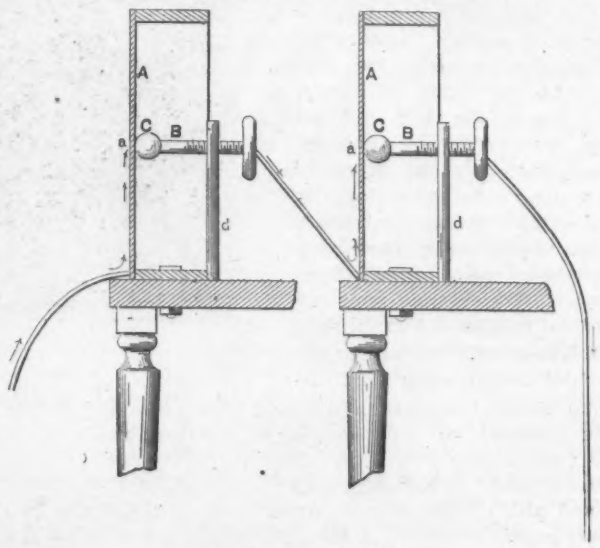
BERLINER—1880.

if not absolutely essential to the operation and very existence o a successful telephone system. Many of these patents have, however, but a short period of future existence.

Briefly, the present patent status appears to be as folows:

The fundamental patent issued to Alexander Graham Bell, covering the art of electrical telephony, expired at its full term early in 1893. One year later the broad patents expired, which controlled the use of the magneto telephone as either a transmitter or a receiver and the field was thrown open to the public for the use of such instruments. The magnetotransmitter, however, utilizing as it does at best only a portion of the energy of the voice for transmission, would never satisfy the demands for a commercial transmitter.

The battery transmitter, claimed broadly and fundamentally in the voided Berliner patent, operated on an entirely distinct and different



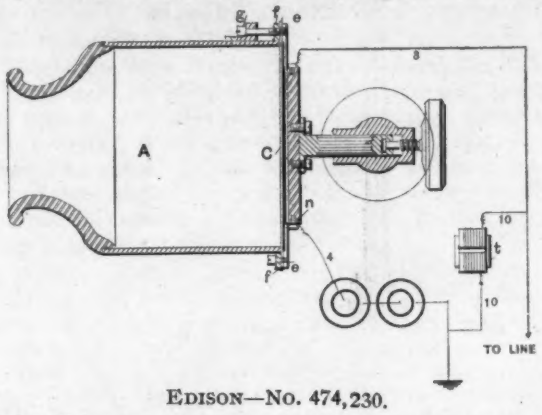

BERLINER—1891.

principle from these magneto instruments. No longer was the voice required to *transmit* its energy out upon the line but only to act as a throttle valve for the energy of transmission, which energy is supplied by a separate source of power, *i. e.*, a battery. Thus, and only thus, did long distance telephony become a reality.

The full effect, however, of the decision of Judge Carpenter in throwing all forms of the present commercial battery transmitters open is dependent upon the present statute law, now contested in the Bate Refrigerator case, being sustained to the public, and the decision does not in any way affect, of course, the firmly woven network of switchboard and detail patents which are controlled by the American Bell Telephone Company, and its ally, the Western Electric Company.

The detail patents granted to Francis Blake and owned by the American Bell Telephone Company, covering many essential but detail features and of the present commercial "Blake" transmitter, have already expired by limitation due to British patents under the now famous section 4,887 of the Revised Statutes. The broad fundamental idea of this transmitter is contained in the patent granted to Thos. A Edison, No. 474,211, filed on July 20, 1877, and issued almost fifteen years later, on May 3, 1892.

In this the claim reads: "In a telegraphic apparatus operated by sound, the combination with the diaphragm of one or more con-

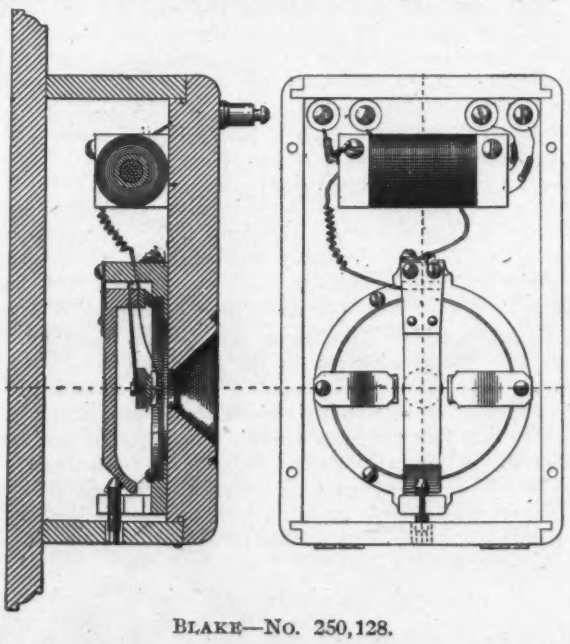



EDISON—NO. 474,230.

tact points of plumbago or similar inferior conductor in the electric circuit, whereby the rise and fall of electric tension is proportionate to the pressure exerted upon the said point or points by the diaphragm, substantially as set forth."

This patent, together with the two sister patents of Edison numbered 474,330 and 474,332, and covering further details of the Blake transmitter, are invalid under the present interpretation of section 4,887 Revised Statutes, as they were issued subsequent to the *expiration* of the British patent No. 2,409, July 30, 1891, for the same inventions. The Blake transmitter, in its essential details, is therefore public property. Should the Supreme Court, however, reverse in the Bate Refrigerator case the present interpretation of this statute, the life of this patent will be revived, but this, in the opinion of many able lawyers, is a very remote contingency.

Coming now to the class of transmitters using finely divided carbon or electrically similar substance, and which include that class of transmitters in use by the American Bell Telephone Company for all



BLAKE—NO. 250,128.

"Long Distance" service, we find that the two fundamental American patents numbered 246,512 and 250,250, issued to Henry Hunning, of England, on Aug. 30, 1881 and Nov. 29, 1881, expired by limitation on Sept. 16, 1892, on account of Hunning's previous English patent of Sept. 16, 1878, covering the same inventions.

This date being even previous to the date of the *filing* of the American patent, there is no question raised as to its definite expiration under Section 4,887. But while these patents were fundamental and claimed "as a tension-regulator or means for varying the resistance in a telephone transmitter finely divided conducting material in a loose or free state, substantially is described," yet there are other detail patents belonging to the American Bell Telephone Company which have assisted in the perfecting of the present long-distance transmitter. Thus, although carbon itself is not the exclusive property of the Bell Company for telephonic purposes, yet it possesses a patent granted to Thos. A. Edison, July 9, 1889, numbered 406,567 on "an electrode for telephones composed of a body of granules of carbonized hard coal," which covers that particular grade of carbon which has been found to be excellently adapted for transmitter purposes. The mechanical structure of the present long distance transmitter is also covered by the patent issued to Anthony G. White, on Nov.

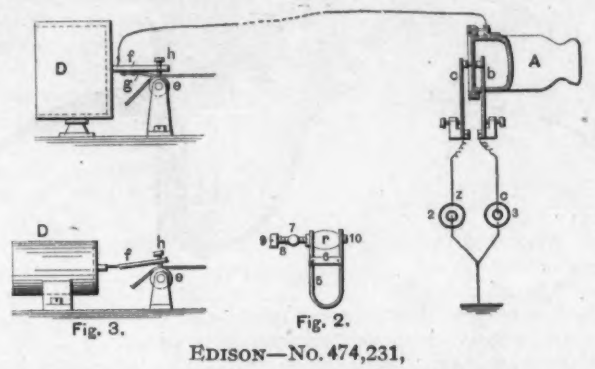


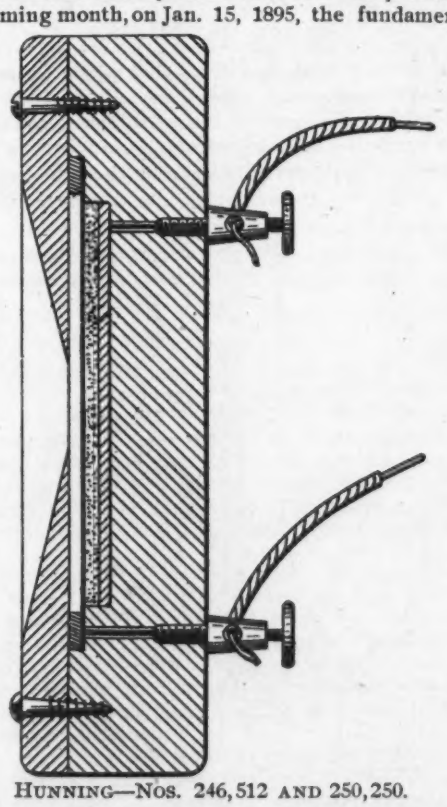

Fig. 3. Fig. 2.

EDISON—NO. 474,231,

1, 1892 numbered 458,311. But it is apparent that even without the aid of the Supreme Court decision of the Bate Refrigerator case, the production of a commercial long-distance transmitter avoiding all infringements of American Bell Telephone Company's patents and employing finely divided carbon or other conducting substance is dependent only upon a knowledge of the art and the requisite skill in mechanical construction.

But having secured a transmitter and the present magneto receiver, the question of operation arises.

It was early found highly advantageous to use the induction coil in connection with the battery transmitter for telephonic purposes. Within the coming month, on Jan. 15, 1895, the fundamental patent

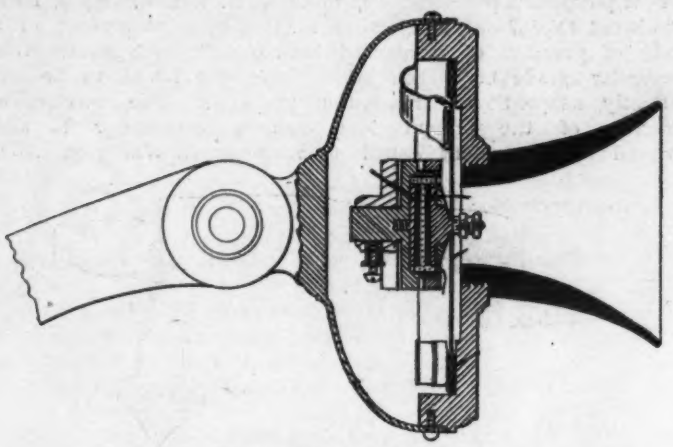


HUNNING—NOS. 246,512 AND 250,250.

on the use of an induction coil for telephonic purposes will expire. This is the patent issued to Emile Berliner, Jan. 15, 1878, numbered 199,141, and reissued Dec 14, 1880, numbered 9,499.

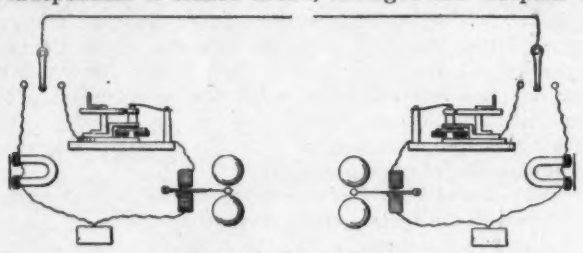
Other combination patents are, however, in force with longer terms before expiration which are of sufficient importance to demand attention. The most important of these are, perhaps, those of Thomas Watson, issued Jan. 9, 1883, numbered 270,522, and April, 16, 1878, numbered 202,495. The former of these two broadly claims the combination of the induction coil with any form of a switch which severs the "call" circuit and "makes" the talking circuit, or the reverse. This patent does not expire until Jan. 9,

1900, and by some writers of very recent date has been considered to be almost an unsurmountable obstacle in the equipment of a subscribers' station by a competitor of the American Bell Telephone Company. But when we consider the fact that for several years such a



WHITE—No. 485,311.

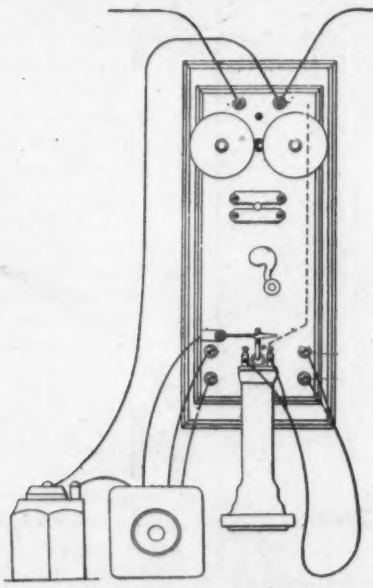
combination and switch have constituted an abandoned method by the American Bell Telephone Company, it is useless to spend any more "sleepless nights" over the subject. The latter patent, however, No. 202,495, claims broadly the use of a signalling apparatus in an independent or branch circuit, arranged and adopted to call



WATSON—No. 202,495.

the attention of the distant operator, and were it not that this patent expires in less than four months, on April 16, 1895, it might cause considerable uneasiness for the would be competitor.

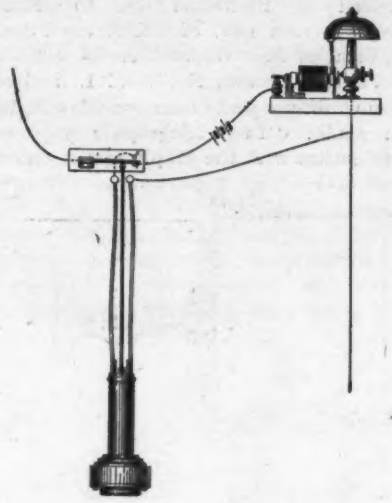
Aside from such combination patents, the receiver switch, or hook itself, has received marked attention from the American Bell and



WATSON—No. 270,522.

from numerous inventors who have assigned patents to it, but a careful examination of these many patents fails to reveal the monopoly of a telephone hook suitable for all commercial purposes, even including the extremely broad claims of the Roosevelt patent, No. 215,837 which will expire on May 27,1896. This, then, narrows the question down to one of switchboards and similar operating devices.

While there appears to be no restraining force to prevent the use of an ordinary plug, connecting boards for switchboard purposes and annunciators for signalling purposes, such as are suitable and advantageous for smaller town and village exchanges, yet the multiple switchboard and its essential combinations, with the necessary busy tests and operators' devices, such as have been found to be highly advantageous to a quick and economical service in the



ROOSEVELT—No. 215,837.

larger exchanges of our cities, are so fully and intricately tied up that their consideration must necessarily pass from the hand of the editor to the hands of the engineer and inventor.

## What Is Thought of the Telephone Decision.

There has been no decision since that affecting the validity of the Edison lamp so important to the electrical industries as that handed down last week by Judge Carpenter at Boston annulling the patent for the Berliner transmitter. The following expressions of opinion will therefore be read with interest, coming as they do from men prominently identified with telephone interests, and thus naturally aquainted with the intricacies of the situation:

J. E. Keelyn, president Western Telephone Construction Company, Chicago: "The decision will undoubtedly result in the active installation of telephone exchanges in nearly all of the smaller cities and villages of the United States and the connection of one with the other. It is probable that the larger cities will find difficulty in overcoming the environments of strong existing companies, but cities of 50,000 or less population will undoubtedly be revolutionized in the character of their service and rates for the same in the immediate future. This competition will necessarily force a self-protecting attitude upon the part of the Bell Company's licensees in the cities as stated. The low rates will not admit of paying royalties and dividends to both the Bell Company and licensee companies. This must involve difficulty, probably also violation of contracts and litigation. The prospect for the next year is that the Bell Company will be kept too busy taking care of affairs with its licensees to worry competing companies, and the latter will be kept busy increasing their business."

E. A. Catlin, president The Mason Telephone Company, Richmond, Va.: "The decision in the Berliner case was by no means a surprise to us. Law and justice, if we may separate the two, pointed to such a result. The American people are certainly tired of the heavy taxations put upon them by monopolies, and they demand that where there exists a doubt, it shall be construed in their favor. Two years hence, one will wonder why men of common sense so short a time back could have thought there was any doubt as to the outcome. Certain it is that purchasers of our telephones will no longer have any fears."

Maj. S. W. Groesbeck, president Brown Telephone and Telegraph Company, Chicago: "The effect of the decision will, of course, be to open the field for numberless companies to make and sell the Bell Company's telephone apparatus. With few exceptions these companies will have but an ephemeral existence, but we may look for improvements in the telephone and ability in catering to the public on the part of a few companies, which will insure lower rates to users of all forms of telephones. Regarding the magneto phone, the public esteems it as inferior, and until a much greater advance is made in the efficiency of that instrument there will be but a limited demand for it. In long distance work the Bell Company will easily hold the lead, but in local exchanges it will be compelled very soon to lower its tolls."

J. J. Gorman, manager of the Manhattan Electric Supply Com-

pany, New York: "Thus far we have confined ourselves to the manufacture of magneto telephones, but since the decision we have put the question to our attorneys whether it would be advisable for us to manufacture battery telephones. If they decide affirmatively we will begin the manufacture of battery telephones at once."

F. P. Fish, counsel for the Bell Telephone Company: "As attorney for the defendants in the case, I do not wish to discuss any of the technicalities involved in the recent decision. We have a right to appeal and will do so as soon as the decree is issued. I do not expect a decision from the Circuit Court of Appeals next spring, as some of the papers quoted me as saying, but I think the case will be argued by April."

Park Benjamin, New York: "I have not seen the full text of Judge Carpenter's decision, but so far as I have read the case seems to have been decided more on legal technicalities than on either merit or priority. It is a question of patent law, not of electrical invention. However, I think the decision will lead to developments in patent litigation now unlooked for, as the court's present holding puts an entirely different phase on some of the former decisions in telephone patent cases."

E. S. Wallace, attorney of the Columbia Telephone Manufacturing Company, of New York: "While our legal position was unassailable before the decision of Judge Carpenter, we rejoice that the people are freed from the incubus of a grasping monopoly. Telephones have become a necessity in every household, and the public is entitled to telephone service at fair prices. The people will now have no fear of litigation, and will not be subjected to threats or intimidations. A wide open field is presented and we expect our 'phones' to come into general use. In the other matter of subways and franchises, the Bell people have undoubtedly a hold which cannot be shaken for many years. We can compete with them in the small towns, and by lowering prices in suburban places, the urban population will, after a while, begin to rebel at the higher city rates. The Bell people will then either have to reduce prices or some of their competitors will eventually get the city business. Our exchange system is of our own invention, works automatically, and we consider it superior to any other in use."

U. T. Fackenthall, manager of the Drawbaugh Telephone Company, New York: "This decision puts us in a stronger position than we ever were before in regard to telephone patent rights. We expect to compete with the existing telephone service in both large and small cities, and we shall push our system vigorously. As the telephone, like the telegraph, requires a company with heavy capitalization to fulfill the demands of the public, probably only a few companies will eventually survive in the now open competition, and we expect to be one of them."

T. J. McGuire, manager Phoenix Telephone Company, New York: "We now make only magneto telephones, so the decision will have little weight with us either way."

Barnard & Hoopes, Philadelphia: "We regard the decision simply as a step towards demonstrating the right of the general public to enter into the telephone business, and feel confident that future decisions will be in line with this one."

W. E. Russell, of the Danbury Electrical Works, Danbury, Conn: "We can but acknowledge the justice in the decision of the court in declaring the Berliner patent void. And we feel that competition in the telephone business will now begin in earnest, and that low rental charges must prevail in exchange work."

J. D. Leatherbee, treasurer National Telephone Manufacturing Company, Boston: "This company determined its policy with reference to electrical telephones some time last winter. The Berliner patent subject was thoroughly considered, and we have no reason to regret the decision reached with reference to our policy, which we had no doubt would be upheld and confirmed by the United States Court. We never for one moment thought that such a monopoly could be perpetuated for another term of years, when the fact was taken into consideration that the Bell Company was the sole owner and proprietor of all the inventions in controversy. I will simply add that we believe the decision will be far reaching, and I know you will excuse me from saying anything more on the subject at this time, for we are very much abused every day by customers who think we are doing them great injustice in not shipping telephones more promptly."

American Mutual Telephone Co., New Brunswick, N.J, by Arthur Pomeroy, secretary. "No one who is acquainted with the telephone situation will question that the recent decision strikes a severe blow at battery-phone patents controlled by the Bell Company. At the same time it is also a fact beyond any possible doubt, in our opinion, that the opposition companies introducing systems wherein battery carbon transmitters are used will have many obstacles to overcome in the form of the induction coil, the automatic hook switch, etc., all of which we consider absolutely necessary to give good battery-phone exchange service.

"In view of this fact our company has concluded to make no effort for the present to introduce battery-carbon phone systems.

"We believe, however, that the recent decision against the Bell Company will hasten the time when battery-phones, and all appliances thereto will be open to the public, as many of the patents above referred to have no great length of time to run.

"Like other manufacturers of phones, switch-boards and telephone exchange appliances, we pride ourselves on having the best system in the market, but before blowing our own horn to any extent we are going to show the public what we can do with a magneto system that is absolutely non-infringing.

"Our magnetophone is entirely different from any other form of magneto transmitter ever produced, and if it does not prove to be fifty per cent. better in the transmission of speech and articulation than any magnetophone we have had the pleasure of testing in exchange service, we shall not attempt to build our second exchange.

"Our facilities are such that we can manufacture several forms of battery carbon phones about equal to the Blake transmitter, but we invariably tell customers that we are willing to do so only on the condition that the purchaser shall take the risk of being interferred with by the Bell Company.

"We are frank to state that in our opinion the public is misled on one point with reference to the recent decision, in that the cancelling of the Berliner patent does not leave the long distance battery phone now in use by the Bell Company free, as there are many points not covered by the annulled patent, which we think are absolutely necessary to give battery phone service anything like that which is now furnished by the Bell Company.

"When we have completed our Freehold (N. J.) exchange, which will not be later than January 10, we shall be pleased to give you an opportunity to examine it, and let it speak on its own merits."

## The American Bell's "Policy of Silence."

An effort by THE ELECTRICAL WORLD to secure on behalf of its readers the views of the Bell Company with regard to the recent Berliner decision, did not meet with the success it deserved.

The refusal, however, was so neatly conveyed that we ourselves quite enjoyed the quiet humor of the note in which the indisposition to discuss the matter was so delicately put. In fact, we consider it so excellent that we share the *bon mot* with our readers.

This is the letter (written as a personal communication to a gentleman whose name as representing the American Bell is as well known as the telephone itself) asking for the views:

New York, Dec. 19th, 1894.

Dear Mr. ———

Judge Carpenter does not seem to have followed the example of most of the other Judges, who have decided cases in which the American Bell Company was interested.

I do not know whether this outcome of the suit was what you gentlemen of the American Bell expected, but we should be very glad to have for publication in the issue which (on account of the Christmas holiday) will go to press on Friday, your views or the views, of Mr. ———, or of some one else representing the company, as to the probable effect of the decision.

Mr. T. C. Platt sometimes sends to the newspapers interviews with himself. If we cannot get an opinion over a man's signature, possibly we could get him to interview himself and send us the result.

Of course you appreciate that our only object is to be perfectly fair and impartial in giving the views of a number of men respecting the decision. Most of these will, naturally, be from those whose interests are opposed to that of your company, and that is why we would like something from the American Bell.

Kindly see what you can do for us in the matter and very much oblige.

With kind regards and the Compliments of the Season,

I remain, sincerely yours,

W. J. JOHNSTON.

Here is the reply, received on Friday morning:

Dear Mr. Johnston: In response to your request (for an opinion regarding the Berliner case) it gives me pleasure to cordially reciprocate the personal good wishes contained in your letter. Trusting you will have a pleasant and happy Christmas, I am,

Very truly yours,

———.

It seems a pity that a man who can write so admirable a letter should have to worry even for a moment over an adverse law decision.

## Rope Driving—XIII.

BY J. J. FLATHER.

For the ordinary factory shafting from which power is taken fairly uniformly throughout its length and distributed horizontally to counter or auxilliary shafts, situated on one or both sides of the main shaft, there will be three general cases to be considered, as shown in Figs. 41, 42 and 43, and each of these cases will be

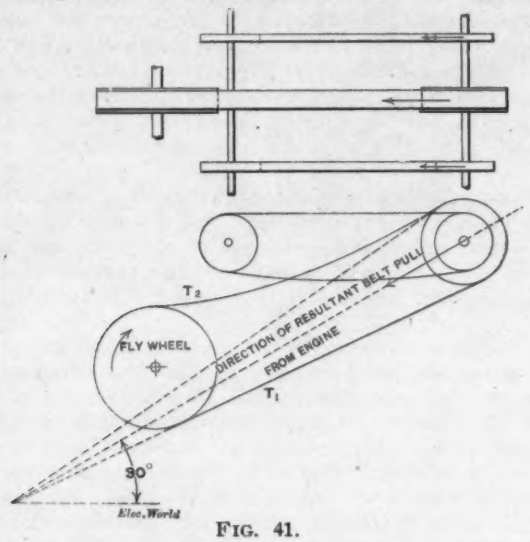



FIG. 41.

modified, depending upon the direction of the belt to and from the main shaft.

For our present purposes it will be sufficient to take that case in which the shaft friction is a maximum for the assumed direction of belt pull corresponding to the arrangement shown in Fig. 41.

The friction will evidently be proportional to the weight of the shaft and the unbalanced belt pull acting on the shaft.

The weight of pulleys, belts and couplings carried by the line shaft will vary from about one and one-half to three times the weight of

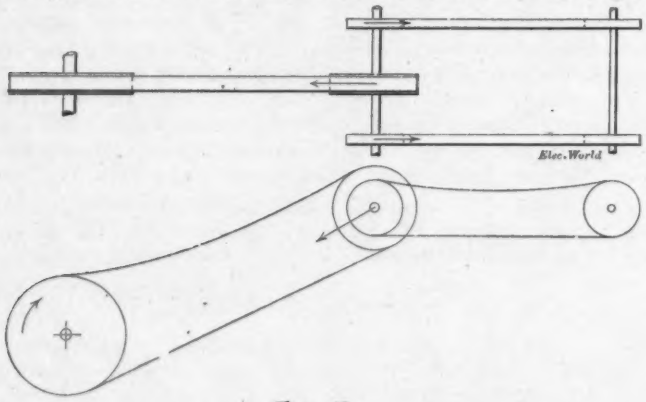



FIG. 42.

shaft, so that the total weight on the bearings will vary from two and one-half to four times the weight of shaft; for head and jack-shafts the total weight will probably vary from three to five times the weight of shaft.

In addition to this weight there is the unbalanced belt pull, which increases the load on the bearings. Although the tension on the tight side of the belt should not ordinarily exceed about twice the tension in the slack side necessary for adhesion, yet it is probable that belts are frequently run with a ratio of tension equal to one to three, and occasionally one to four; on the other hand, it is a very common thing for belts, especially short ones, to be laced so taut that the initial tension is greatly in excess of that required for adhesion, in which case the sum of the tension approaches twice that in the tight side of the belt.*

With ordinary shopworn belting it will be safe to assume that the tension $T_2$ on the slack side of the belts is one-half the tension $T_1$ on the tight or driving side, that is, $T_2 = \frac{T_1}{2}$; hence, since $T_1 - T_2 = P$, the driving force, we have $\frac{T_1}{2} = P$, and $\text{HP} = \frac{T_1}{2} \times \frac{V}{33000}$.

The velocity of intermediate belting is so variable that any assumption of speed must be regarded as applying to a particular case or representative of a certain type of factory, and cannot be taken as general. In many machine shops the average speed of intermediate belts is not more than 500 feet per minute; in others the average speed is more than twice as great, and in wood-working shops it is still greater.

For our present purpose we shall assume an average speed of 660 feet per minute for belts running from the main shaft to a secondary or counter shaft.

Substituting this value in $\text{HP} = \frac{T_1}{2} \times \frac{V}{33000}$ there is obtained $T_1 = \frac{2 \times 33000}{660} \text{HP} = 100 \times \text{HP}$; but since the horse-power transmitted by the shaft $= \frac{d^3 N}{100}$ we have the tension on the tight side of all the belts $\Sigma\ T_1 = 100 \times \frac{d^3 N}{100} = d^3 N$, therefore the sum of tensions $\Sigma\ (T_1 + T_2) = \frac{3}{2} d^3 N$, and the pull per foot of length of shaft $= \frac{3 d^3 N}{2 L}$.

In the present case it will be noted by reference to Fig. 41 that there is an additional pull on the bearings due to the tensions in the belt from fly wheel to main line shaft. If the ratio of tight to slack side tension remains the same as before, and we consider that

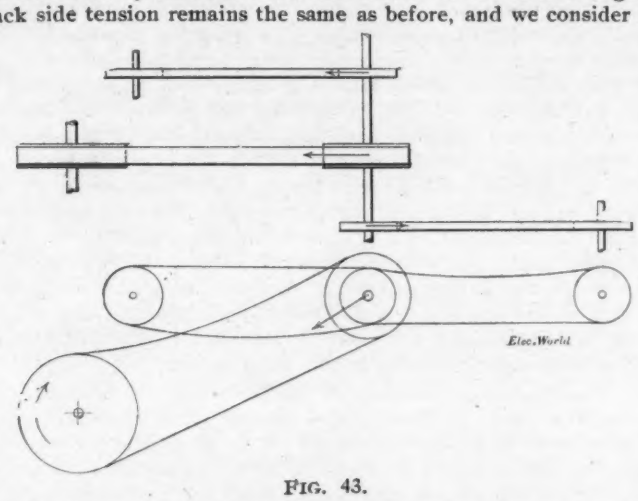



FIG. 43.

the velocity of main belt is four times as great as that of the intermediate belting, the additional belt pull will equal approximately one-fourth of the sum of the belt pulls from the main to the counter shafts or machinery. The resultant of these tensions, combined with the weight of shafting and pulleys, will be the effective load on the bearings.

(To be continued.)

*We have seen shop belts laced so tight that they would barely drive their countershafts or machine spindles, and yet by slacking out the lacing or inserting a short piece of belt heavy cuts could be taken where it was almost impossible to run the machine empty with the tight belt.

## New York City Subways.

Mr. Albert R. Ledoux, in a letter to the New York *Evening Post*, recommends that provision be made by the Rapid Transit Commission in its plans for the disposal of underground wires.

He says that under the terms of the franchise bestowed upon the Metropolitan Telephone Company (indirectly), by which they construct and receive the rental of electrical subways in this city, the municipality has the right to take over these subways at some future time. Whether the city avails itself of its rights under this particular contract or not, there is no question but that at some period it will come into possession of these subways; the people will demand it.

Mr. Ledoux states that in his first report to the commissioners of electrical subways, he advocated a tunnel system for the disposal of the wires, gas and water pipes, but the expense precluded the adoption of this system. It occurs to him now that in connection with the tunnels of the rapid transit system, at very little increased expense, a compartment for wires could be provided that would care for all the trunk lines up and down the island, carrying also the out of-town lines which diverge up the Hudson River, and along the New Haven, Railways respectively.

## A Direct-Connected Arc Light Station.

The first direct-connected arc light station in the United States was started on the night of December 17, at the station of the Mutual Electric Light and Power Company, Chicago. The plant consists of Willans' engines direct-connected to 125-light Brush dynamos running Brush-Adams lamps. This is a commencement which promises to relieve arc lighting of the reproach that it has lagged far behind in the march of electrical progress.

## Rapid Transit.

BY C. WELLMAN PARKS.

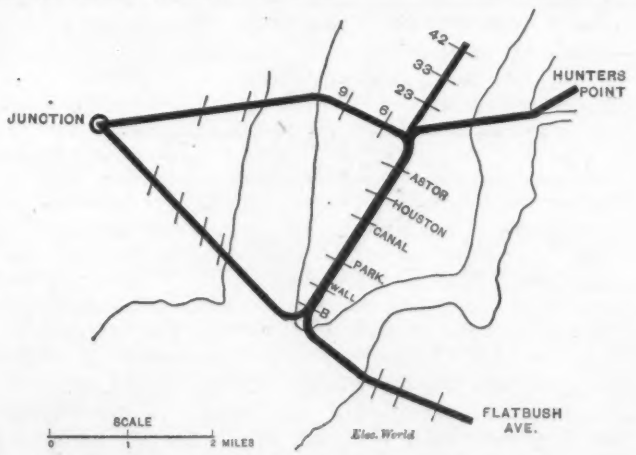
The people of New York having at the last election given favorable majorities to the Rapid Transit and Greater New York propositions, must be understood to want all whose daily business life is spent in New York to be able to live under the same municipal government and to circulate freely between their homes and places of business.

Until now the plans which have been favorably considered by the Rapid Transit Commission have been devised for the almost exclusive benefit of the residents of the upper end of Manhattan Island and the district north of the Harlem River. This is as it should be, but there are other residence quarters which need attention. Residents of New Jersey and Long Island are waiting as patiently as possible for the time when they will be able to reach their business in New York without quite so many transfers as at present. The Brooklyn Bridge and the ferries care for this traffic about as well as they can, but no system can be perfect which requires two transfers. In the case of the Brooklyn Bridge I have never felt quite sure that these transfers are necessary, for it has seemed possible to find some way to run through cars from stations on the Brooklyn roads to the Grand Central Depot and also through Chambers or Reade to Church Street and so to the Battery.

It is proposed to avoid one transfer, so far as New Jersey passengers are concerned, by the erection of a gigantic bridge across the North River. Trains which arrive over this bridge would land their passengers in an immense union station rather too far uptown to accommodate any but the shopping people. The congestion of traffic at a terminal and transfer station located as that one would be could not but result in many serious accidents. While this bridge plan may be perfectly good from that engineering standpoint which ignores cost, it does not seem to be practicable from the broader engineering standpoint which does consider outlay and return. The absurdity of the requirement that piers shall not be erected in the river cannot be discussed at this time.

The proposition to build two bridges to connect the Manhattan and Long Island railroads is much more attractive, but if the project is carried out it will be found to be very costly.

Whatever may be done for the purely urban traffic, the New Jersey and Long Island traffic needs attention, and the following plan is suggested to show what can be done by using tunnels. Nearly all of this traffic originating outside of New York must reach the city below Fourteenth Street. I would propose then, as the backbone of the system, a four-track tunnel under Broadway or a

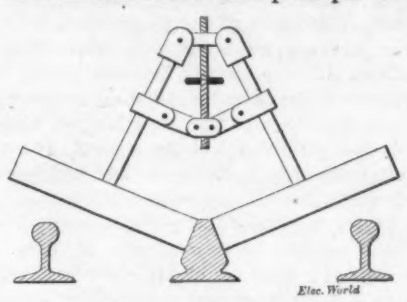



MAP OF PROPOSED ROUTES.

neighboring street, from Union Square to the Battery with stations at Union Square, Astor Place, Houston Street, Canal Street, City Hall, Wall Street, and the Battery. As the four sub-surface tracks of the Rapid Transit Commission's Broadway line will be required for the Manhattan Island traffic, the proposed tunnel would be independent of and much deeper than their subway. At Union Square the main line would be joined by a two-track line from the Grand Central Depot, a two-track tunnel from Hunter's Point, and the Hoboken tunnel through Fourteenth Street. At the Battery the main tunnel would be joined by two-track tunnels from Flatbush Avenue, Brooklyn, and the west side of Jersey City Heights, where a grand junction of all of the New Jersey railroads and the Hoboken and Jersey City tunnels would be made.

As we are no longer confined to the use of coal burning locomotives, clean electric motors can be used to propel the trains, and electricity can be used to operate the pumps and light the tunnel and trains. Ordinary locomotives would not be practicable unless easy grades were secured, either by building the tunnels in the shifting silt which overlies the rock in the bed of the North River, or by building very long approaches to tunnels built in the rock a couple of hundred feet below the surface of the river.

The Van Zile Electric Tractor, which has worked satisfactorily on a trial track, makes it possible to use as heavy a grade as is needed, even five thousand feet to the mile if passengers could keep their seats on such a grade. This tractor is built on the unusual principle of automatically controlled pressure between the driving wheels and the rail instead of the usual principle of pressure con-




ELECTRIC TRACTOR.

trolled by grade. In the former case when more power is required the pressure is increased, in the latter case when climbing grades where more power is required than on a level the pressure is decreased so that less instead of more power is available.

In place of the usual vertical driving wheels the Van Zile electric tractor uses pairs of horizontal or inclined wheels which press upon opposite sides of a third or traction rail. It will be seen that if these wheels can be drawn towards each other by the Van Zile apparatus, a toggle joint or other contrivance, a single pair of drivers can be made to furnish as much traction as a mogul engine on a level track. The pull on an inclined track is as much as on the level, for it is in no way influenced by the grade. If inclined drivers are used the track and switches can be easily built and maintained.

With such motors it will be easy to work trains through the tunnels at a uniform speed over all grades. Traction being independent of the weight of the motors, they can be made as light as is consistent with the rules of good electrical and mechanical construction.

This system of tunnels would enable every road entering New York to land its passengers at stations near their destinations; it would enable New Jersey and Long Island railroads to operate belt lines; it would enable the New York Central and the New York, New Haven, and Hartford Railroads to remove their car sheds to Brooklyn and their round houses to the northern limits of the city; and it would greatly facilitate the transmission of mails by making it possible to load and unload all mail cars at the Post Office.

The whole system could be built and equipped for less than $25,000,000, or about half as much as a single span bridge across the North River will cost.

Its usefulness would exceed that of the Severn, Mersey, Thames, Detroit, and Chicago River Tunnels combined.

## London's New Electric Railway.

The latest projected railway in London, which is to connect Waterloo Station, the terminus of the London and South Western Railway with the very heart of the city, is making rapid progress. It is to be entirely underground; indeed, daylight would have difficulty in penetrating to its depth, and electricity will, therefore, be employed as the propelling power. The many disagreeable features of steam in underground traction are emphatically deterrent to the citizens of London, and even the County Council would hardly dare to countenance a duplicate of the present District Railway, which, as all travelers know, is a slightly modified hades about ten to twenty feet below the street level.

Examinations of the plant show that the railroad will start at Waterloo at a depth of thirty-six feet below the level of the South Western Railroad tracks, and will descend in the direction of the River Thames at a gradient of one in sixty. The track will then pass diagonally beneath the river for a distance of some three hundred yards, and will ascend in the direction of the city at a gradient of one in eighty-eight. The tunnel beneath the Thames will be cut at a depth of about twenty-four feet below the river bed, or, in other words, the level of the underground tracks will be about sixty-two feet below the Thames high water mark.

On the Surrey or south side of the river, at Cross Street, where the road will pass underneath the viaduct of the London and South Eastern Railway the depth will be about forty-eight feet, at the junction of Waterloo Road and Stamford Street thirty-eight feet, and at Hatfield Street not less than fifty-six feet.

After reaching the Middlesex or city side of the Thames, the first important road under which the tracks pass will be the Victoria Embankment, where the level of the rails will be seventy-eight feet below the surface of the roadway. Thence this electric railroad passes under the District Underground tracks, until at St. Andrew's Hill, the electric will follow the same route as the District, and so nearly that the centre line of the upper route will be the centre line of the lower, as far as Friday Street. Here they diverge, and the Electric railway continues along beneath Queen Victoria Street to its terminus directly opposite the northeast corner of the Mansion House, the official residence of the Lord Mayor, when the rails will be sixty-five feet below the level of the street. The profile of the road, with its alternate rapid descents and sharp rises, makes it look very much like a switchback railway.

The total length of the line will be about one and a half miles, and the tracks will be laid in two tunnels of cast iron, one for each direction, laid at a distance of four feet from each other. The internal diameter of the tunnels on the straight or on a flat curve will be twelve feet; on a sharp curve they will be widened to twelve feet nine inches to avoid possible contact of the ends of the cars, which will be suspended on bogie trucks, with the sides. The stations will be constructed in special tunnels, which, like those of the road itself, will be of cast iron. They will be of course comparatively spacious, the internal diameter being twenty-three feet. Both tunnels will be constructed on the Greathead principle.

The trains will run directly from terminus to terminus without stops and will make the journey in about four minutes, at an average speed of twenty-two miles an hour.

The station platform of the electric railway at Waterloo being at a depth of only thirty-six feet, elevators will not be used, the travelers attaining the platforms by a series of easy declines. At the Mansion House, however, where a distance of sixty-five feet separates the passenger from the street, huge hydraulically operated elevators will be used, and these are to be designed of ample capacity to cope with the enormous traffic which will probably fall to the road.

The details of the electrical installation have not yet been definitely determined, but with the City and South London underground and the Liverpool overhead railways as object lessons, it may be surmised that they will be even more perfect. The use of electric locomotives, as in the former road, will doubtless not be considered, the advantages in favor of the motor car, as in our own Intramural Railway, being sufficiently numerous to recommend it for this special work.

On the Surrey side of the river, near the west side of Blackfriars Bridge, a long platform was erected last June, at which time the excavation of the tunnel shaft was commenced. From near Hatfield Street, running toward the Mansion House, the two tunnels will be in London clay, but as the line rises in the other direction, that is toward Waterloo, it will meet ballast, and as large volumes of water will be encountered here, this portion of the road will be constructed under heavy air pressure, as was found necessary in the case of the City and South London Railway.

At Blackfriars, two cast iron cylindrical shafts have been sunk to a depth of forty-feet below high water mark, one above each of the projected tunnels. Below the cylinders the shafts are of brick work in cement, and the shaft over the up tunnel is about completed. The object of commencing the work by sinking these two shafts in the river is to allow of the excavated material being raised and dumped directly into barges.

As soon as the requisite depth is attained, the four protecting shields and the mechanical excavators will be lowered into position, and the driving of the tunnels will go on simultaneously in both directions. As the earth is cut away the shields will be pushed forward by hydraulic pressure, and the iron segments be let into place, each segment or ring advancing the tunnel about two feet. Mr. Dalrymple Hay is the engineer in charge.

## A Caselli Commemoration Medal.

At Florence, says *L'Electricità*, an influential committee has been constituted for the purpose of coining a medal in honor of Giovanni Caselli, of Siena, the inventor of the pantelegraph. This instrument, intended to transmit writing and designs to a distance, was first exhibited at the Italian Exhibition at Florence in 1861.

## Sparking of Closed Coil Dynamos.

BY GEORGE T. HANCHETT.

This most fruitful source of trouble and annoyance to the average station engineer, is much more readily met if a knowledge of the causes and remedies is available. To some extent a closed coil commutator requires a certain amount of care, closely akin to what in common parlance is termed "monkeying." That is, the application of certain adjustments and combination of brushes and pressure on the commutator for no other good reason than that they stop the sparking. But it is also true that there are certain technical points which have a general application to closed coil dynamos, and which cannot be neglected if sparkless running is to be understood.

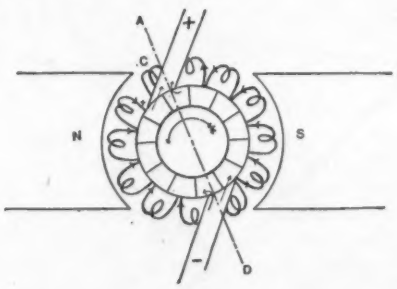
In a closed coil dynamo, whether drum or ring, the current approaches the brush in two directions from the two halves of the armature. This is shown in figure 1. In the figure are shown the commutator bars, and between every commutator bar is a loop of wire so wound around the armature core as to assist in producing electro-motive force when the armature is in motion in its field.

Various inventors give these loops peculiar forms and connect in different ways, but the principle is in each case the same. It is evident that the bobbins on either side of the brush are of opposite polarity, and hence both send the current toward the brush in the direction of the arrows. The coil C is momentarily short circuited by the brush, and whatever the direction of its electro-motive force, when delivered to the north side of the armature, the current in it will flow toward the brush. If, therefore, it is released before it gets well out of the south field, the electro-motive force in the bobbin will be in opposition to the current that is forced through it by the other bobbins, and rather than instantly establish the full current in the resisting bobbin a bright spark will occur at $x$.

If we rock the brush forward until the bobbin $c$ clears the south field, and is discharged upon the north side empty of all current, we shall have bettered matters somewhat, but since it takes time to establish current in a coil wound about iron, or in other words such a coil is self-inductive, a spark will still occur at $x$, although a smaller spark than in the first case.

If now we rock the brush so far forward that the bobbin $c$ enters the north field sufficiently to establish in it a current equal to and in the same direction as the full current in that side of the armature where it is released, there should be no spark at $x$.

In a well designed dynamo the amount that the brush should be rocked past the neutral line is very small. The bobbin is of low




resistance, and the field is strong. All the electro-motive force generated is used in establishing this current in the bobbin. If the bobbin is well short circuited, only a fraction of a volt is necessary. Hence, if a carbon or high resistance brush is used it must have a thicker bearing surface than a low resistance copper brush, for the commutating bobbin must be swung further into the north field before the necessary current is established therein.

It is possible to secure sparklessness by short circuiting $c$ for a shorter length of time in a stronger field by rocking the thin high resistance brush still further forward, but this tends to throw bobbins with reverse electro-motive force on the south side of the machine, which makes the machine work against itself and reduces the output. The bobbin should be short circuited by the brush the instant it ceases to have electro-motive force, and the brush should have thickness of bearing surface enough to hold it thus until the full current is established in the reverse direction. It is easy to see that the higher the resistance of the brush the more thick ness of bearing surface it should have.

On general principles this is so because the area of contact shoul be greater in order to transmit the main current.

This may be remedied by increasing the breadth of the brush,

but to properly commutate the bobbin, the brush of higher resistance should have increased thickness as well.

A little consideration will show that while one set of brushes may be set correctly the other is not necessarily so.

In a good bipolar machine the brushes are diametrically opposite. However, the field magnets may not establish a uniform field, and in that case diametrically opposite brushes will secure sparkless running for only one set of brushes. The other set must be set to the magnetic rather than the geometrical point of non-sparking. When the load of such a machine changes and both brushes spark in consequence, mere rocking of the brushes will correct only one set. The other must be adjusted as before, and hence such a machine is an endless source of trouble. This fault is more liable to occur with ring than with drum armatures.

Having thus obtained an idea of the way a bobbin is reversed under the brush, we are in a position to consider the various causes of sparking and their remedies.

There are several distinct kinds of sparks which appear at the brushes of a closed coil dynamo. First, those due to an imperfectly commutated bobbin, which are of a bluish, flashy nature These are not very destructive to the commutator. Second, those due to imperfect or insufficient contact. These are of a deep, yellowish red color and cut deep ruts in the commutator if allowed to continue.

These two are liable to appear on a dynamo in the best of order. There are also intermittent sparks due to a local defect in the armature.

To a man not familiar with the two different kinds of sparks, their distinction is a little puzzling. The spark of the improperly commutated bobbin may be produced by rocking the brushes out of position.

The second kind may be produced by applying an excess of oil to the commutator with the brushes set correctly.

The writer does not advise any prolonged experiments of this nature with a nicely polished commutator. The information may in such a case cost too dear.

It is, however, important to distinguish between the sparks in order that the correct remedies may be applied.

The bluish spark, due to an improperly commutated bobbin, is due only to incorrect position of the brush on the commutator. Even a thin brush, if not too thin, may be given sufficient lead to stop this sparking.

If the field is unsymmetrical, as is sometimes the case, each set of brushes must be set separately at each change of load. An expert designer can often correct an unsymmetrical field by properly shaping the pole pieces.

The other kind of sparking is due to difficulties of a mechanical nature. A rough, uneven commutator may cause the brushes to jump and spark. If the commutator is not very rough, sandpaper may be used to smooth it, but if the commutator is very rough, there is no remedy but to turn it down.

Oil or foreign substance sometimes causes sparking.

The heat caused by the current will vaporize the oil under the brush and make a poor contact worse. The remedy is obvious.

If the current is so great as to cause a heavy overload, the brushes will spark. This, of course, is not the fault of the dynamo, and efforts should be made to reduce the load.

If the brushes spark intermittently, keeping step with the revolutions of the dynamo, there is a local defect in the armature. This may be due to one of the commutator bars being too high or too low, or to a loose bar.

In the case of a high bar, see if it is not also loose by gently tapping it with a mallet. If it drives back with light blows, tighten the retaining rings. Never drive a bar back into position by a heavy blow, as the insulation may be damaged.

In the case of a low bar tighten the commutator rings, if necessary, and turn down true.

High, low and loose bars occur only in very poorly made commutators.

It sometimes happens that the connection of a single bar has become loosened or broken, due to centrifugal force, magnetic drag or both.

This will cause an intermittent spark. If the commutator is truly round and smooth, the bar at fault may be distinguished from the fact that the bar in front is bitten away by the intermittent spark. This should be remedied at once, for that bar may become lower than the rest and a "flat" be produced.

In general, sparking will be avoided if the following suggestions are followed:

The commutator should be true, smooth, well made and of good material, and free from local defects.

The brush should have a smooth well, trimmed surface, with no frayed ends to make a loose contact.

It should have sufficient area of contact to carry the current.

It should have sufficient depth of contact to properly commutate the bobbin.

In the case of a set of brushes this may be secured by leading one brush a little in advance of the others. This is indeed often done. Experiment is the best guide as to how much this brush should be led.

The brushes should be set in the proper position on the commutator. Pressure of the brushes on the commutator should be just enough to stop the sparking and no more. The lighter the touch of the brush on the commutator consistently with no spark the better.

Most closed coil commutators run better with a very little oil. It should be applied very cautiously with a bit of felt.

No commutator of this type does well with an excess of oil, and a few run better without any. Experience is here the best guide.

Some manufacturers put poor insulation into their commutators. These men frown upon the use of any oil at all for obvious reasons.

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## Electrical Power Transmission—VI.

BY LOUIS BELL, Ph. D.

*Power Transmission by Continuous Currents.*

31. Case II—Series motors worked at constant potential are very widely used for electric railway service and other cases, such as hoisting, in which great variations of both speed and torque are desirable. When supplied at constant potential the speed of a series wound motor varies widely with the load. In any case the speed increases until the counter E. M. F. rises high enough to cut the current down to the amount necessary to give the torque sufficient for that load and speed.

If the field be strengthened the motor will give a certain output at a lower speed than before; if it be weakened, at a higher speed; the torque being in these cases correspondingly increased or decreased.

The torque increases rapidly with the current so that when the counter E. M. F. is small, or *nil* as in starting from rest, the torque is very great, a property of immense value in starting heavy loads. For in starting not only is the current through the armature large, but the field is at its maximum strength. If the field strength varied directly as the current the torque would vary nearly as the square of the current.

As a rule, however, these, like most other motors, are worked with a fairly intense magnetization of the fields so that doubling the magnetizing current by no means doubles the strength of the field. In fact, most series motors for constant potential circuits are of the type used for electric railways and wound so that the field magnets are nearly saturated even with very moderate currents. Hence the torque in such cases increases but a trifle faster than the current. This construction is adopted in order to reduce the amount of iron necessary to secure a given strength of field, and so to lighten and cheapen the motor.

It is quite obvious that while series motors at constant potential have the advantage of being able to give on occasion very great torque they suffer from the same disadvantage as constant current motors in that they are not self regulating for constant speed. A centrifugal governor could of course be arranged to do the work but since it happens that most work requiring great torque also requires variable speed, nothing of the kind is usually necessary.

As previously explained the speed can be easily regulated to a certain extent by hanging the field strength, thus changing the counter E. M. F., but owing to the peculiarity of design just noted, this method is rather ineffective, requiring a great change in the field winding for a moderate change in speed.

In general, when a considerable range of speed is needed, constant potential working is abandoned and the speed is changed by varying the impressed E. M. F. by means of a rheostat. If this E. M. F. be lowered, the current decreases and the speed sags off until the new counter E. M. F. is low enough to let pass just enough current to maintain the output at the reduced speed. When the applied E. M. F. is increased the reverse action takes place. Under these circumstances for a fixed load the current is approximately the same independent of the speed; for with a uniform load the torque is constant although the output (*i. e.* rate of driving the load) varies. All railway motors are regulated in the manner just described, although in addition the field strength is sometimes varied by cutting out or recombining fields. Rheostatic control necessarily wastes energy, and the greatest recent improvement in railway

ractice consists in reducing the E. M. F. applied to the car motors by throwing the two in series. This secures a low speed economically though the rheostat still comes into play at intermediate speeds.

Speaking broadly then, series wound motors while possessing some valuable properties, are limited in their usefulness by their tendency to vary widely in speed when the load changes. Hence they are "used chiefly in cases where the speed is to be varied deliberately. A typical motor of this class, such as is used for hoists and the like, with rheostatic control, is shown in Fig. 19.

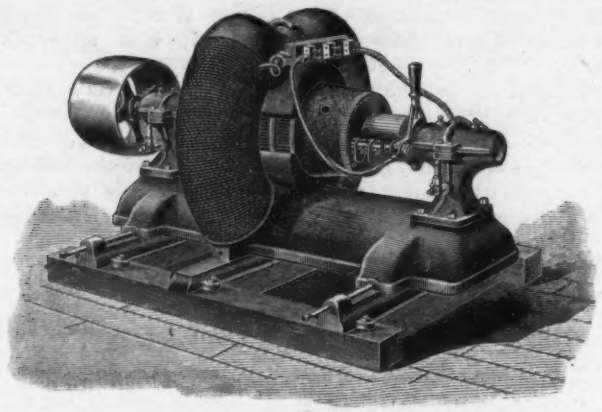


FIG. 19.

In spite of the difficulty in regulation, the series motor possesses some considerable advantages. The field coils being of coarse wire are easily and cheaply wound even in motors for very high voltage; the same quick response to changes in current or load that makes it hard to obtain uniform speed is also most important in many kinds of work; the powerful initial torque, coupled with the kindred property of prompt reversal; all these make the series motor preëminent for certain purposes, especially where severe work is to be coupled to hard usage.

There is one case, too, in which the series wound motor can be made accurately self-regulating for constant speed—a case somewhat peculiar and unusual, but yet worthy of special attention.

32. Case III—We have seen that when the load on a series motor supplied at a certain voltage increases the speed falls off until the increasing current due to the lessened counter E. M. F. raises the torque sufficiently to meet the new conditions. Imagine now that the impressed E. M. F.'s were so varied that the slightest increase of current in the motor should be met by a rise in the E. M. F. applied to it. Evidently the speed would not have to fall as before, for the greater applied voltage would furnish ample current for all the needs of the load. If the variation in voltage could be made

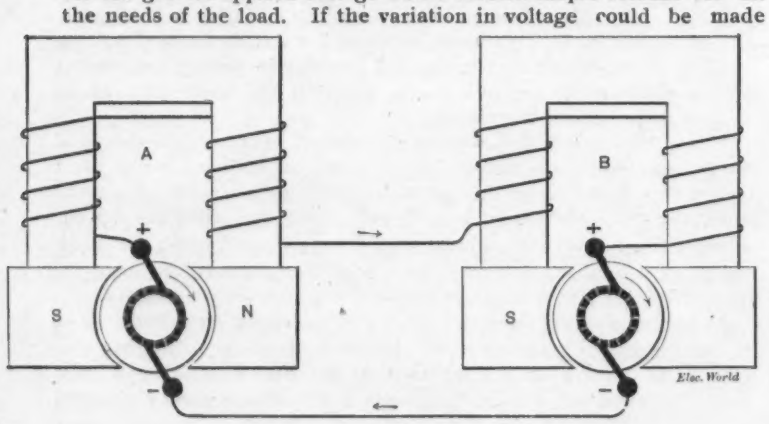



FIG. 20.

to depend on change of torque, not giving the speed time to change, the regulation would be almost perfect. Such a method has been proposed, but owing to mechanical difficulties has not been used to any extent.

It is possible, however, so to combine a special motor and generator that the former will be very closely uniform in speed quite independent of the load. In this connection we must revert to the properties of the series wound dynamos. If such a machine be driven at constant speed its electro-motive force will increase with the current since the strength of field, here the only variable factor in the voltage, will increase with the current. If the field magnets of the generator are unsaturated, that is not so strongly magnetized as to require considerable current to produce a moderate increase of magnetization, they will respond very promptly to an increase of load by raising the voltage. If such a generator be connected to a series wound motor of proper design, the pair will work together almost as if connected by a belt instead of a long line, and the motor will run at a nearly uniform speed, since the least diminution of speed, with its accompanying increase of current, will be met by a rise in the voltage of the generator. Such an arrangement is shown in diagram in Fig. 20.

In this Fig. A is the generator supplying current to the motor B. The machines should be of practically the same output for the generator cannot supply current except to the one motor without disturbing the regulation. Whenever the load on B changes, a very small reduction in speed suffices to raise the voltage of A and thereby hold up the speed of B. To this end the field magnets of B must be more strongly saturated than those of A, else the same increase of current would raise the counter E. M. F. of the motor and its armature reaction, and defeat the purpose of the combination. If the fields of the two machines are properly designed the generator will increase its voltage under load just enough to hold the motor at speed, as a very slight change in current immediately reacts on the generator.

It is even possible to make the motor rise in speed under load if the generator is sufficiently sensitive to changes of current. This is generally needless, but it is often useful so to design A and B that the former will rise in voltage fast enough not only to compensate for the added load on the motor but for the added loss of energy in the line, entailed by the increase of current, thus regulating the motor even at a long distance. It is needless to say that such a system must be so arranged that the generator will take care of everything that tends to change the speed. When properly adjusted the system is capable of holding the motor speed constant within two per cent. through the range of load for which the machines are planned.

It should be noted in connection with Fig. 22 that whereas the current circulating in the armature of a generator tends to disturb the magnetic field in one direction in a motor the same reaction is in the opposite direction. For the current in the motor is driven through the armature against the counter E. M. F., *i. e.* in the direction opposite to that of the current the machine would give if running as a generator. As the effect of the reaction is to skew the direction of the magnetic field that affects the armature conductors and the commutation must take place when the commuted coil is not under a varying induction, the armature reaction compels one to shift the brushes slightly away from the position they would have if the field were perfectly symmetrical. This shifting is in the direction of armature rotation in a generator, but for the reason above noted has the opposite direction in a motor, as shown in the figure.

(To be continued.)

## Electrodynamic Machinery—XX.

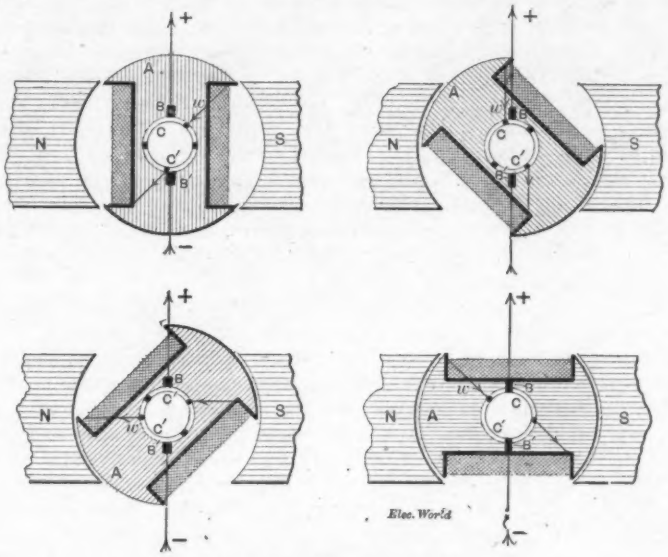
BY EDWIN J. HOUSTON AND A. E. KENNELLY.

101. Having thus obtained the value of the flux passing through the armature, it is a simple matter to determine the E. M. F. at any speed of rotation; for we have only to reconstruct the flux diagram of Fig. 85, to a horizontal scale of time in seconds, instead of angular displacement. This is shown in Fig. 86, for an assumed rate of rotation of 1.5 revolutions per second, or 90 revolutions per minute, the horizontal distance of $O\,M'$, being taken as one second, and the vertical scale being taken for convenience smaller than in Fig. 85.

The E. M. F. produced in any single loop or turn around the armature will be the rate of increase in the flux passing through the armature If at the position $O$, commencing the curve, we continue the curve along the dotted tangent of $O\,O'$ for one second of time, we reach the ordinate $m\,O'$ of 770 kilowebers, and this is the rate at which flux is entering the loop at that moment; for if the rate at $O$, were continued uniformly for an entire second, we should evidently reach the point $O'$. The E. M. F. existing at the moment of starting is, therefore, 770,000 C. G. S. units (of which 100 million make one volt) or 0.0077 volt, and if the number of turns around the armature core be 1,000, the total E. M. F. in the armature winding will be 7.7 volts. Again, if after a lapse of 1-6th of a second, the flux curve $o\,a\,b\,c\,d\,e\,f\,g\,h\,i\,k\,l\,m\,n$, be examined, it will be found that the curve has reached the point $b$, or its maximum positive value when it commences to descend towards $g$, and where the tangent is horizontal, representing that the rate of change of flux is zero, or similar to the condition of slack water in a tideway. At this point, therefore, the E. M. F.

in each turn on the armature is zero and the curve of E. M. F. *O A B C D*, etc. touches the zero line.

Again at the point *q*, on the flux curve, if the change of flux were to continue for one second uniformly at this rate, we should follow the dotted line or tangent *q q'*, which reaches the ordinate —400, or 500 below *q'* so that the rate of change at the point *q*, on the curve is 500 kilowebers, represented by the point *Q*, on the E. M. F. curve at that ordinate. Continuing in this way we trace the E. M. F. curve *O A B C D*, etc., showing that an alternating E. M. F. is produced in the armature, varying between + 7.7 and — 7.7 volts. At the rate of rotation assumed, namely 1½ revolutions per second, there will be three alternations of E. M. F. per second, or twice the number of revolutions in that time.




FIGS. 81, 82, 64 AND 83.

102. Having now examined the means for determining the value of the E. M. F. developed in the armature, we will consider the effect of the commutator. It will be seen by reference to Figs. 81 to 84, that the brushes *B*, *B'* resting on the segments of the two-part commutator, the direction of E. M. F. from the armature towards the external circuit is reversed at the moment when the core passes the position of maximum contained flux, as indicated by the change in the direction of the dotted loops *C' D' E'* and *L' M' N'*, relatively to the horizontal line. The E. M. F. generated by the armature is produced at the brushes *B*, *B'*, will be represented by the pulsating E. M. F., *O A B C' D' E' F G H I K L' M' N'*. It is evident that had we selected a higher rate of rotation the E. M. F. of the machine would have been correspondingly increased.

103. The preceding considerations can only determine the value of the E. M. F. at the brushes, while the external circuit is open. As soon as the circuit of the armature is closed, the E. M. F. at the brushes is reduced, for the following reasons; viz. because,

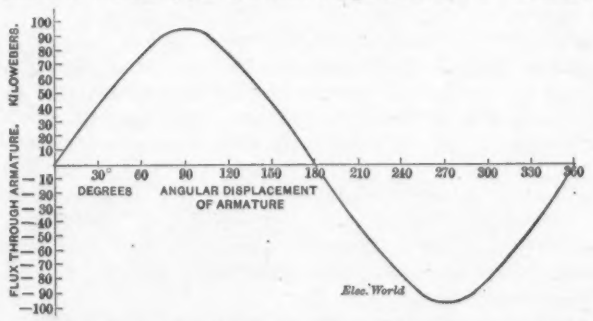



FIG. 85.—DIAGRAM OF FLUX PASSING THROUGH ARMATURE IN DIFFERENT ANGULAR POSITIONS.

(1). The current in the armature produces an M. M. F., always counter, or opposite to the M. M. F. of the field magnet, and, therefore, diminishes the flux through the magnetic circuit, thus causing a corresponding diminution in the value of the E. M. F. produced. Indeed, this opposing M. M. F. may, under certain circumstances, assume a magnitude sufficient to neutralize and destroy the permanent M. M. F. in the field magnets. This is one of the reasons why magneto generators are not employed on a large scale in practice.

(2.) The current through the armature produces in the resistance of the armature, a drop in the E. M. F. If, for example, the current through the armature at any instant be one ampere, and the resistance of the armature be 10 ohms, then the drop of E. M. F. produced in the armature will, in accordance with Ohm's law, be $1 \times 10 = 10$ volts.

(3.) The current through the armature not being steady, but pulsating, the variations in current strength will induce E. M. F.'s

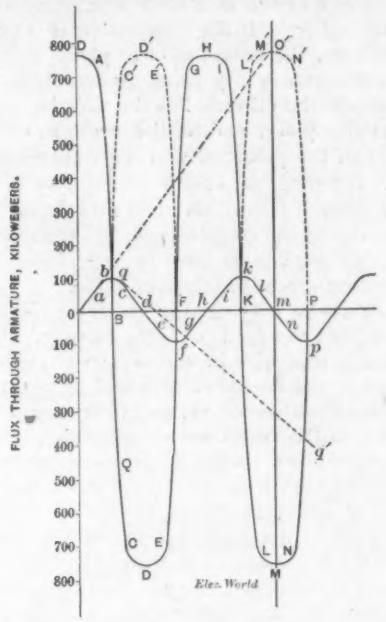



FIG. 86.—DIAGRAM OF FLUX PASSING THROUGH ARMATURE AT DIFFERENT PERIODS OF TIME.

in the coil opposed to the change and, therefore, reducing the effective E. M. F.

(To be continued).

Laboratory of Houston & Kennelly, Philadelphia.

## Electrical Difference of Potential—An Analogy.

*To the Editor of The Electrical World:*

SIR:—In the article by Mr. John Waddell, printed in THE ELECTRICAL WORLD of Dec. 8th, giving a mechanical analogy of the generation of an E. M. F. in a conductor moving across a magnetic field, it is stated that the friction of the steel wires on the sides of the box requires an expenditure of energy when the box is moved, and that this is analogous to the expenditure of energy required in moving a conductor across a magnetic field to generate an E. M. F.

No energy is required to move a conductor in a magnetic field other than that required to overcome the friction, inertia, etc., of the conductor, so long as no current is flowing in the conductor in any direction; that is, none of the energy required to move the conductor can be charged to the generation of the E. M. F., so it would seem that, in this respect at least, the analogy is imperfect, although in its other features it seems to be a very good one.

Scranton, Pa. A. W. K. PEIRCE.

*To the Editor of The Electrical World:*

SIR:—The criticism of my article made by Mr. Peirce seems at first sight to be well founded; but there is an argument which induces me to believe that it is incorrect, and I shall describe an experiment which, if there is no error in the way in which it was carried out, leads to the same result.

I understand Mr. Peirce's criticism to be this:

Work is done in the air box, described by the motion of the paddles, because of the flow of air from one end of the box to the other, whereby compression and rarefaction are effected. This work is due merely to the friction of the air in its passage, because the heating produced in the air that is compressed is counterbalanced by the cooling in the rarefied air.

Mr. Peirce conceives that there is nothing correponding to this phenomenon, in the case where difference of potential is created by the movement of a wire across a field of force. The formula, $W = E\,C\,t$ is, I suppose, the basis of his assertion; the current being zero, the work would be zero. I think, however, that this formula does not warrant the conclusion drawn in the above instance.

In a statical machine of the old type, the knob connected with

the rubber becomes, in the old phraseology, negatively electrified, and the knob which is charged from the glass, positively electrified. In other words, there is a difference of potential produced between the two knobs. If connection is made between the two a spark will pass, which shows that work must have been done in creating the difference of potential. The case is analogous if a wire is moved across lines of force. Suppose the conditions to be such that the one end of the wire is of one hundred volts higher potential than the other. If the conduction is uniform, and the field of force uniform, the potential of a plane cutting across the middle of the conductor is fifty volts higher than one end, and fifty volts lower than the other. Let the wire be supposed instantaneously cut at this place, and let the motion of the parts then cease. In each half the potential will equalize itself throughout; but manifestly, the potential of one half will be fifty volts higher than that of the other. If connection is now made between these two parts, there will be a transference of electricity, and work will be done, which work must have been performed on the conductor, by its motion across the field of force.

A way in which a wire may cut lines of force, is for the wire to remain stationary, but the field of force to vary. If an insulated wire run by the side of a wire in which an alternating current is passing, each end of the insulated wire will be alternately of higher and lower potential than the other; and if my argument be correct, and work be done in the variations of potential, the wire should be heated. Therefore, in the ordinary transformer, even if the secondary circuit is open, heat should be developed in it. I am not in a position to make the test, and I am doubtful whether the rise in temperature *could* be detected, because of the small capacity of the circuit. (If my letter were not already so long, I should explain in what way I consider that the capacity affects the matter, but perhaps explanation is unnecessary). The telephone is a more delicate instrument than the thermometer, and should, in the case suggested above, emit sounds when inserted in the insulated line. I tried a corresponding experiment with a Ruhmkorff's coil. It is well known that if a telephone be inserted in the secondary circuit of a Ruhmkorff's coil, it will emit loud sounds. I joined the telephone with *one terminal only*, of the coil, the other terminal having no wire attached. No sound was heard in the telephone, but *when the capacity of the line was increased* by connecting it with the inside of a large Leyden jar battery, the outside of which was put to earth, *sounds were quite audible.*

Again when the Leyden jar battery was inserted *between* one terminal of the secondary coil and one binding screw of the telephone, the other binding screw of which was joined *directly* to the other terminal of the coil, the *sounds were almost as loud* as when a complete circuit was made through the telephone. In this case the capacity of the line was larger than by the other arrangement of the Leyden jars, and the work done in the telephone was greater.

Incidentally, while planning some experiments with a view to throwing light on the point just discussed, I passed the interrupted current of the primary of a Ruhmkorff's coil through a voltameter, and noted the amount of the mixed gases produced, in a given time, both when the secondary circuit was closed and when it was open. In the former case, the amount of gas produced was greater than in the latter, in about the proportion of seven to four. This is an easy lecture experiment, illustrating the difference of counter electric-motive force, in the primary circuit of a transformer, the secondary circuit of which is without or with load.

John Waddell.

Royal Military College of Canada, Kingston, Ontario.

## Consumption of Alternating Arcs.

*To the Editor of The Electrical World:*

Sir:—In The Electrical World of Dec. 15, I notice an interesting communication from Messrs. Bedell and Crehore by which an explanation of the unequal consumption of alternating arc carbons is attempted. While I agree with the authors that with an unsymmetrical alternating current the consumption may become unequal in case the energy expended during successive semi periods is not equal, I cannot admit the hypothesis which I find here implied, namely, that an increase of electrical energy—the electric quantity remaining constant—shall generally produce a greater waste of the carbons. With the view of completing their demonstration you will permit me to offer my own explanation of the phenomenon.

The thing that has first to be explained is the higher temperature of the positive carbon terminal of a continuous current arc. This temperature difference, according to my theory, is based on the action of a thermo-electricity. It is an experimental fact that the passage of a current through heterogeneous substances causes—independent of the Joule effect—evolutions or absorption of heat at the places of contact. In a circuit of iron and copper for instance, a current will cool the junction in passing from copper to iron and heat the other junction in passing from iron to copper. Now in a circuit consisting of carbon and an arc we must expect the same thermal effects to occur. In fact the excessive heating of the positive carbon is such a phenomenon; the negative pole is simultaneously cooled. This view can be fully substantiated by electrochemical considerations. In fact the Peltier effect and the thermal phenomena of a voltaic cell are very closely related. The transfer of electric quantity between the poles of arc carbons is analogous with the transfer of electric quantity between the electrodes of a galvanic cell; this transfer being effected in both cases by ions or atoms. The latest views of electro-chemistry make this analogy still more striking, for the behavior of the ions in elctrolytic solutions is perfectly identical with that of gases. Electrolytic dissociation into ions has to precede the transfer of electricity, and so with an arc the dissociation of the gases has to precede discharge. We see then that the absorption and evolution of heat of the arc carbons, which is proportional to the current, is exactly the same thing as the thermal effects we are so well familiar with at the surface of contact of electrodes and the solution in which they are immersed. That the higher temperature f the positive carbon causes a more rapid waste is natural.

We will now consider what we must expect to take place under such conditions as are assumed by Messrs. Bedell and Crehore.

Suppose we have an alternating current whose positive waves and negative waves are of unequal energy but of equal quantity.

Let the current from $A$ to $B$ have the greater energy. Then it is necessary that the square root of the mean square of the instantaneous values of this waves E. M. F. should be larger than that of the opposite wave from $B$ to $A$. Remembering now that the E. M. F. is proportional to the rate of cutting the lines of force and assuming that the semi-periods are of equal duration, we must conclude that during a relevant portion of the semi-period $A - B$ the rate of cutting the lines of force, and consequently the current, is greater than that during a like portion of the semi-period of $B$ to $A$. Now since the evolution of heat due to the Peltier effect is directly proportional to the current, it follows that during the semi-period $A - B$ a relevant portion of heat is developed in shorter time than a comparable quantity of heat during the semi-period $B$ to $A$. From the general laws of radiation we know that the rise of temperature of the body is necessarily the greater, the shorter the time during which we impart heat. The temperature of $A$ will therefore exceed that of $B$ and the waste of $A$ will be greater. We see then, that there is no direct connection between electrical energy and consumption of carbon, as we have shown that in general the waste of carbon depends on the magnitude of the current and of course on the length of time during which a certain quantity of electricity is being transferred.

Ithaca, N. Y. Alfred H. Bucherer.

## Fly-Wheel Accidents in Power Houses.

*To the Editor of The Electrical World:*

Sir:—I wish to correct a slight mistake in the automatic cut-out suggested by Mr. A. H. Burnett in your issue of Dec. 8, although the majority of your readers may have already noticed it.

He proposes to connect a magnet with a polarized armature, in shunt with the armature of a generator running in parallel with others, so that in case the generator starts to run as a motor and takes current from the bus bars, the polarity of the magnet will be reversed, causing it to repel its armature, and close a contact in the circuit of another magnet operating a switch, and thus cut out the generator.

The error is in assuming that the polarity of the generator will be reversed in the event of its running as a motor. A few moments thought will show that its polarity does not reverse, but its E. M. F. simply falls below that of the bus bars and allows the current to flow back through it against its own E. M. F., which corresponds exactly to the counter E. M. F. of a motor. The only way its E. M. F. could become reversed is by its taking so much current that the series field winding entirely overpowers the shunt and reverses the polarity of the field. This could not happen if an equalizer were used, so it is safe to say it never does happen in a railway power station.

His arrangement would work all right by placing it in series with the armature instead of in shunt with it.

New York, N. Y. M. P. Ryder.

# DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

COMPILED FROM PRINCIPAL FOREIGN ELECTRICAL JOURNALS

BY CARL HERING

## ELECTRO-PHYSICS.

*Tesla Effects With Influence Machine.*—The first part of an abstract of a lecture by Dr. Toepler (inventor of the Toepler-Holtz machine) is published in the "Zeit. fuer Elek.," Dec. 1. He describes a number of experiments made with his multiple plate machines, and shows the advantages of using such a machine with 20 plates for making researches with high frequency currents; the machine itself is well known, but was improved slightly to increase the self-excitation and the intensity of the current for a very high voltage. He shows its application for produing some of the Hertz effects and states that it gives two different kinds of primary sparks. With this machine the fundamental experiments of Tesla can be demonstrated, although it consumes only 1-16 to 1-18-hp; better results were obtained with a 60-plate machine requiring ⅛-hp. The connections are the same as usual, the machine discharging through a spark-gap, the poles of which are connected to condensers whose outer coatings discharge through the primary of a transformer, the secondary current of which is used to produce the effects; with a large machine he obtains 100 sparks per second 3 mm. long; one of the chief advantages of using influence machines is that it gives the high tension and high frequency alternating currents directly; also that a better symmetry is obtained, for with an unsymmetrical system, discharges in one direction are obtained which are disturbing; no air-blast or magnetic field is in this case necessary to rupture the current in the spark-gap and to this he attributes, in part, the success of the results. A Geissler tube in this circuit shows the cathode light at both poles which proves that the current is an oscillating one, while with a Ruhmkorff coil the cathode light is produced at only one pole. The article is to be continued.

## MAGNETISM.

*Curious Magnetic Phenomena.*—In the Lond. "Elec.," Dec. 7, Mr. Burnie gives the results of some experiments made to explain the phenomena described by Mr. Lloyd (see Digest, Dec. 15). Mr. Lloyd's experiment was made with magnets which had previously been broken, whereas the present writer began with an unbroken bar magnet; in this he found that when magnetized, there were two consequent poles somewhat resembling those obtained by Mr. Lloyd; he then tried by a number of different methods of magnetization, to destroy these, but in every case the result was similar to that at first obtained; the same results were also obtained with other bar magnets of different lengths, though they were much less marked with short magnets; he finds that the ends of the bar were harder than the centre, that there was a rapid change of hardness at the consequent poles, and that the magnets were liable to break at the consequent poles; he believes that the ends induce the consequent poles in the more permeable central portion; on breaking these magnets it was found that they broke easily at these consequent poles; when broken elsewhere no such reflection of the cracks was obtained; he concludes among other things that in many bar magnets there are consequent poles due to the variations in the hardness in steel, that bar magnets usually break at one of these poles, that they are usually symmetrical and that the apparent image noticed by Mr. Lloyd was due to one of these consequent poles and not to the break.

*Change of Length With Magnetization.*—A paper by Mr. Nagaoka from the "Weid. Ann.," Vol. 53, page 487, is briefly abstracted in the "Elek. Zeit.," Dec. 16. He used the ovoids of Prof. du Bois, made of iron, nickel and cobalt; the curve for the square of the magnetization and the elongation resembles a hyperbola for iron and cobalt; for nickel it differs from a straight line only with strong magnetization; for weak magnetization the changes of length of all three metals varies in a linear ratio with the square of the magnetization, according to Joule's law.

## UNITS, MEASUREMENTS AND INSTRUMENTS.

*Determination of the Conductivity and the Dielectric Constant.*—In a paper by Dr. Nernst published in the report of the meeting of the German Electro-Chemical Society, he discusses an apparatus for measuring the dielectric constant which can be used also for determining the conductivity and the polarization constant; it consists in general of a bridge, two arms of which are resistances, the other two containing the condensors which are shunted, the latter being important, for without this shunt the method cannot be used owing to the fact that the dielectric is not an absolute insulator; an alternating current and a telephone are used; very rapid oscillations are essential. Dr. Froelich called attention to a slight error in the results.

*Measuring Coefficients of Induction With a Telephone.*—An article by Mr. Heydweiler from the "Weid. Ann.," Vol. 53, page 499, is abstracted briefly in the "Elek. Zeit.," Dec. 6. He shows that contrary to the experience of Foster, the telephone can be used instead of the galvanometer if slight changes are made in Foster's method.

*Electro-Chemical Actinometry.*—The original paper of Mr. Marechal, mentioned in the Digest Dec. 15, is published in full with illustrations in the "Bul. Soc. Int. des Elec." for November.

*Bolometric Investigations.*—A translation of a paper by Messrs. Lummer & Kurlfaum from the "Weid. Ann.," Vol. 46, page 204, 1892, is published in the Lond. "Elec.," Dec. 7.

*Alternate Current Measuring Instruments.*—In a discussion published in the "Elek. Zeit.," Dec. 6, Mr. Dobrowolski stated that alternating current measuring instruments with iron are of use only for the particular current curves with which they have been calibrated; it is not possible to have such instruments with saturated iron, as the saturation exists only during a portion of the time of the current impulse, the result of which is that the curve representing the field in the iron does not correspond at all with that of the surrounding coil and that neither a mean nor a quadratic value of the curve can be found from the deflection; the scale will change with every different current curve, not according to any simple ratio, but quite irregularly.

*Imperial Reichsanstalt.*—A paper by Dr. Feussner on the work of this department is published in the "Elek. Zeit.," Dec. 6; it is quite general in character.

*Board of Trade Laboratory.*—The Lond. "Elec.," Dec. 7, publishes three large photographic views of the interior of this laboratory, photographed with the aid of an arc light, magnesium light having been found unsuitable.

## DYNAMOS AND MOTORS.

*Alternating Current Motor System.*—In the "Elek. Zeit.," Dec. 6, Mr. Schulz describes a system used by his company which appears to be similar to that of the General Electrical Co.; the exciter is coupled mechanically with the alternator, and besides supplying the continuous current for the fields it generates an alternating current, whose phase is shifted 90 deg. relatively to that of the alternator; a third circuit running from this machine leads this current to the motors where it is used to start them.

*Unipolar Dynamos*—Mr. Contades in "Cosmos.," Nov. 24, describes, with the aid of an illustration, a machine which has been constructed; it consists essentially of four unipolar disk machines somewhat similar to the Forbes type, but differing in the form of magnet used; two of the disks are on one shaft and two on another, the two shafts being rotated in opposite directions and the disks being connected in series through four sliding contacts; each disk is furthermore divided into 12 sections, each having a separate ring and brush contact, enabling the twelve sections to be connected in series.

*E. M. F. and Current Curves of Alternators.*—The article abstracted in the Digest, Dec. 15, is published in full with all of the numerous illustrations in "L'Eclairage Elec.," Nov. 24.

*Combined Dynamos and Turbine.*—The Hall combination is illustrated and briefly described in the Lond. "Elec.," Dec. 7.

## TRANSFORMERS.

*Open-Circuit Loss in Transformers.*—The Lond. "Elec.," Dec. 7, publishes a short but interesting article by Mr. Partridge in which he gives, in the form of curves, the results of some prolonged measurements which show an increase in the open circuit loss in transformers after they have been working for some time; he believes that this fact has not yet been published by any one; he claims that this is of special importance to transformer makers, who are called upon to guarantee the performance of their plant for a specified period. A large number of experiments show that this increase of waste of power is due to a molecular change or fatigue in the iron, and not to dampness or deterioration in the insulation as might be supposed at first sight; in the latter case, the power factor would increase as the insulation decreased, but his observations show that the power factor remains substantially constant; to prove that the results were not due to the atmosphere he made tests with carefully sealed transformers during a period of four months and compared it to a similar transformer used only when measurements were taken; the power taken by the former showed an increase, while that of the latter remained constant. Two of the curves were taken from 750-watt transformers, one of them beginning with a

loss of 145.1 watts and increasing in 180 days' continual running to a value almost 40 per cent. higher; the original loss in the second was 60.8 watts, which increased almost 30 per cent. in about 30 days and 40 per cent. in about 90 days; the third was for a 15,000-watt transformer working regularly at a sub-station; the original loss was 63 watts, which was increased 40 per cent. in about 6 days after which it varied but averaged about the same.

In a note by Prof. Ewing, he states that the results are so interesting and important that further particulars would be very desirable; it would be interesting to know how the losses were measured, what the value of the induction was, etc.; the observations apparently point to the change in the magnetic qualities of the iron resulting from a repetition of the magnetizing processes; he suggests finding by measurement whether the area of the hysteresis cycle is altered by this exposure to many reversals; it is well known that in a new piece of iron the values of the induction continue to contract appreciably during some scores of reversals, and it would now seem that such a change goes on during millions of cycles resulting in an enlargement of the area relatively to the value of the induction; the effect has an interesting correspondence in what is known as the cumulative influence of repeated strains on the mechanical qualities of metals; Lord Kelvin found that this fatigue tended to disappear during an interval of rest, and it is natural to look for a similar restoration of the magnetic quality through rest; this, together with other reasons, shows that it is desirable to cut out the transformer when it is not doing useful work. Editorially it is stated that this phenomena is new only in a relative sense, intimating that it was known before.

## ARC AND INCANDESCENT LIGHTS.

*Scientific Study of Arc Lamps.*—A ninth paper by Mr. Kennedy is contained in the Lond. "Elec. Rev.," Dec. 7. He discusses series lamps; when running on constant current they are regulated by variations in pressure only; he states that it is important to use a constant current in testing such lamps, for if the current is variable and if there is a main coil (series coil) in the lamp, the test is worthless as far as it concerns series working; it is sometimes claimed that lamps regulated on a variation of one-half a volt, which he says may be corrected when the current also varies and when there is a series coil, but with a series lamp with no series coil one-half the voltage is powerless to feed any lamp in existence. He recommends the use of 120 volts instead of 100 for general use from central stations, partially because with the former three lamps in series may be used.

*Gas Lighting.*—A new device for producing a succession of sparks at the end of the burner by means of a toothed wheel operated by a pendant or by the stop-cock itself, is described and illustrated in the "Elek. Anz." Dec. 6.

## ELECTRIC RAILWAYS.

*Traction.*—The discussion of the institution papers of Wilkinson, Blackwell, Dawson and Preller is published in the Lond. "Elec." and "Elec Rev.," Dec. 7. Mr. Parshall states that the trouble due to earth returns might have been avoided to a great extent "had these return circuits been put in according to principles that were thoroughly well understood; in discussing the bonding of the rails he states that experience with polished copper contacts show that a current density of 300 amperes per square inch for currents up to 500 amperes should not be exceeded, and that for greater currents such a high density was not permissable; with iron contacts, especially when liable to corrosion, 50 amperes per square inch was as high as was safe in most cases; if 1,000 amperes per square inch is taken as the mean permissable density in bonds, the contact should be 20 times the section of the bond; for very large currents he recommends welding the joints. A fair value for the amount of energy taken by ordinary cars from 8,000 to 10,000 lbs. running at 8 to 12 miles per hour, he says is one kilowatt hour per car mile; the current for starting is 40 to 50 amperes with the series parallel controller and corresponds to a horizontal effort of 1,600 to 2,000 lbs. at a periphery of a 33-inch wheel and accelerates the car about two feet per second; the energy taken per car mile remains fairly constant through a wide range of speed. He gave curves (not published) showing the speed, torque and efficiency of a good motor. Regarding the application of alternating currents, he states that the properties of the induction motor, as shown by a curve for the speed and torque, were not such that it compared favorably with continuous current motors for ordinary railway work, but the indirect application of alternating currents to drive commutating dynamos was being successfully carried out; experience in the United States direct connected railway dynamos gave results which were most gratifying. Captain Sankey discusses the strains on the machinery due to short circuits or overloads; with belt driving he does not think the stress so produced would lead to accident because the energy in the fly-wheel was discharged directly into the belt and not through the spokes; with a direct driven dynamo the energy of the fly-wheel had to be discharged through the spokes, and that these stresses might be serious with slow speeds there is no doubt, but there is no risk with small disk fly-wheels at high speeds; he believes that it is not the engine but the armature of the dynamo that would suffer damage by the fly-wheel; he proves this from some calculations which he gives and finds that there is still an ample margin left; in direct driven sets it is only necessary to make the shaft and the armature windings sufficiently strong. Mr. Holroyd Smith described a trolley pole, wire clip, trolley wheel, and rail bond, devised by himself, which are illustrated in the "Electrician;" he advocates the double tread rail and wheels with the centre flange, a plan which had been adopted in Buda Pesth, which he considers the best example of electrical railway.

*Alpine Railway.*—Some further information about the proposed electrical railway to the top of the Jungfrau (one of the highest snow-capped mountains of the Alps) a brief account of which was given in the Digest, March 17, is given in the "Zeit. fuer Elek.," Dec. 1. The total cost is estimated at $1,600,000 for a length of 7.38 miles, a large portion of which is in a tunnel, half-tunnel or under glaciers; the electrical installation and cars are estimated at $70,000; it is estimated that 10,000 passengers per year will be carried to the Eiger Station and 7,000 to the top; the cost of the round trip is to be $9; the question whether passengers could ascend so quickly to such a great height without being injured, was answered favorable by an aeronaut, who stated that he had not experienced this sensation in making ascensions up to 13,000 ft.

*Canal Boat Traction.*—According to the Lond. "Elec.," Dec. 7, a recent trial was made of the Bovet system on the St. Denis Canal; a series motor operated a towing pulley over which a chain passed, which when not in use rests on the bottom of the canal; this chain passes over the pulley for only three-quarters of a turn, being held by friction produced by the magnet which constituted the pulley; the current was taken from trolley wires; the results were said to be very successful, and showed that with 2,000 watts it was possible to obtain a speed of 1.68 miles per hour with a barge weighing 300 tons.

*Street Railways.*—The article mentioned in the Digest, Dec. 15, is concluded in the "Zeit. fuer Elec.," Dec. 1; a large number of estimates of cost are given in detail.

*Dynamometer.*—The Lond. "Elec. Rev.," Dec. 7, abstracts from the "Engineer" a description of the car used in testing the Heilmann locomotive.

## CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

*Regulation of Three-phase Installations.*—A paper by Mr. Lahmeyer, describing his system of regulation when the current is transformed into continuous current, is published in the "Elek. Zeit.," Dec. 6; it appears to be similar to that suggested by Swinburne, and consists in regulating the phase and the voltage.

*Accumulator Stations in Berlin.*—A description of some length, including illustrations of the system of connections, of a station supplying a section of Berlin is given by Mr. Rathenau in the "Elek. Zeit.," Dec. 6.

*Electricity on Board Ship.*—A paper by Mr. Gibbings is abstracted in the Lond. "Elec. Eng.," Dec. 7.

## WIRES, WIRING AND CONDUITS.

*Inductance in Aerial Lines.*—The article by Prof. Blondel (see Digest, Dec. 15) is concluded in "L'Eclairage Elec.," Nov. 24. He discusses simple methods for making numerical calculations of linear inductances; the formulas require the use of a table of logarithms, and in order to dispense with these he publishes two tables, with their corresponding curves, in which he has calculated once for all certain constants, namely, the mutual inductance per unit of length for a number of distances between the axes of the two wires, and the self-inductance per unit of length for different radii of the wire; the results are given both in C. G. S. units and also in millihenrys per kilometer; with the aid of these tables all the calculations can be readily made. He speaks of a very useful quantity which he calls "factor of reactance," which is a ratio of the reactance of a circuit to its homic resistance, and gives tables and curves of the values of this factor for studying single and three-phase circuits. He shows how the results may be applied for calculating the voltage at the beginning of a line. In summarizing his conclusions he states that in comparing the different systems of circuits with regard to the voltage lost, he has proved that the lines consisting of three wires forming an equilateral triangle are the best, but in general the dissymetry induced by placing them in one plane is not appreciable; that triphase lines in general have a negligible inductance, at least many times less than that of a single phase line of the same power, and that it is preferable to diphase circuits; that the latter should be classed between the two others, as far as the inductance is concerned, but that they present even with equal charge an important dissymetry in voltage, which is too often overlooked and which makes it inferior, theoretically at least, for long distance transmissions, and there is, therefore, no longer any reason for using it, as it is possible to convert triphase into diphase currents and vice versa; it furthermore involves an expense of copper which is absolutely useless. The importance of the induction effects may become considerable for single-phase lines with the high frequencies used in America, but the three-phase circuits overcome this inconvenience, and their superiority, therefore, remains incontestible from this point of view, as also in regard to weight of the copper.

*Telephone Loops Without Induction.*—In order to avoid the induction disturbance between one double line and another, the German Telegraph Department runs a pair of these loops in such a way that the two planes through the two loops are at right angles to each other; this answers the purpose, but can be used only with two loops. An arrangement which may be used for any number of loops on a pole is described and illustrated in the "Elek. Zeit.," Dec. 6; the two wires of the same loop are

nine inches apart on the same support, but the supports are 25 inches apart vertically, and are alternately on the right and on the left side of the pole; the principle is, to keep the two wires of the same loop close together, but separate them as much as possible from the other loops; the system has been tried on long lines with success, and will probably be used universally by the German Telegraph Department.

## TELEGRAPHY, TELEPHONY AND SIGNALS.

*Transmission of Time in the United States.*—Mr. Pellissier's article mentioned in the Digest last week is published in full with a number of illustrations in the "Bul. Soc. Int. des Elec.," for November.

*Submarine Telegraphy.*—The article by Mr. Marcillac, mentioned in the Digest, Dec. 15, is continued in "L'Eclairage Elec.," Nov. 24; he describes in detail the Terrin apparatus.

*Watchman's Controller.*—A system is described and illustrated in "L'Elec.," Dec. 1.

## ELECTRO-CHEMISTRY.

*Limits of Electrolysis.*—In a paper by Dr. Le Blanc, published in the report of the meeting of the German Electro-chemical Society, he discusses the want of agreement between theory and experiments in the application of the Thomson law; the paper and the discussion should be read in their entirety. The law applies directly when the E. M. F. does not change with the temperature, but in other cases, which constitute the majority, the temperature coefficient must be taken into account; he discusses the effects of pressure on the liberated gases in the electrolysis of water, and states that as the pressure is diminished, the E. M. F. decreases, being almost zero, when the pressure is nearly zero, in which case water may be electrolized with an exceptionally small E. M. F.; this should be taken into account when applying the law, as the calorific equivalent for constant volume is independent of the pressure, which shows that there can be no direct connection between this equivalent and the electrical energy. He discusses the effect of using different electrodes and finds that with some there is only a momentary current when the E. M. F. increases, until it reaches a certain value, at which continuous decomposition takes place, even though they are all chemically inert; the E. M. F., also depends on the concentration of the two gases on the electrodes, but is almost independent of the nature of the electrolyte; he states that it is possible to construct a cell which gives off the same gases at two poles, differing only in their concentration.

*Electricity Direct from Coal.*—Mr. Powell, in the Lond. "Elec. Rev.," Dec. 7, makes a suggestion which is given in full in THE ELECTRICAL WORLD last week, p. 637.

*Source of Current for Analyses.*—In a paper by Dr. Heim in the report of the German Electro-chemical Society, he recommends the use of accumulators charged with Daniell cells for chemical laboratories, when it is not possible to use a dynamo or to connect with a central station. He suggests using two accumulators, charging them continuously with 12 Daniell cells, with a current of 0.1 to 0.2 amperes, the capacity of the accumulator being about 15 ampere-hours; the accumulators will cost $2.25 each, and the 12 cells, $4; he counts on an output of about 1,000 ampere-hours per year; the consumption of sulphate of copper will be about 330 pounds per year, and that of the zinc, 66 pounds per year.

*Decomposing Composite Anodes.*—In a paper by Dr. Vogel, published in the Report in meeting of the German Electro-chemical Society, he discusses theoretically the decomposition or solution of anodes consisting of a number of chemical substances.

*Accumulators Under Water.*—A correspondent to Lond. "Lightning," Dec. 6, states that during a recent flood a number of the accumulators in his house were covered with two feet of water for about four days, during which time they continued to supply the light without suffering any damage; the high specific gravity of the acid prevented its being displaced to any extent by the water.

## MISCELLANEOUS.

*Globular Lightning.*—An interesting summary of the knowledge existing on this subject is given by Prof. Sauter, in the "Zeit. fuer Elek.," Dec. 1. The following are some of the statements which he makes: These balls of lightning last from one to ten seconds, and even for several minutes; they move slowly from the clouds to the earth and can be followed by the eye, their speed being compared to that of a bird or the running of an animal; they seldom occur without being accompanied by other lightning discharges; sometimes they disappear silently, and sometimes they explode with a noise which is as great as the discharge of 100 cannon; sometimes they travel about without apparently following any law; the light given off is not very great; their size varies from that of a small ball to that of a large millstone; they may revolve, give off sparks or separate into small globes; at times they are accompanied by a slight hissing noise and leave a strong odor of sulphur; a peculiar property is that they sometimes bounce on the floor like a rubber ball, and at times the globe passes through small openings changing its form as if elastic, afterwards becoming again a sphere; sometimes they disappear in a brook or are carried away by the wind; it has happened that they pass through the floor or other subjects in a house making holes through them, but without igniting them; their actions on human beings are different, sometimes they have no effect at all, while at other times they give severe shocks, producing wounds and even death; they seem to be no more frequent in any particular country, nor do they depend on the season. It has been suggested that globular lightning is perhaps only an optical delusion, being perhaps only prolonged images of a dazzling bolt of lightning, and that it has no actual existence; Sir William Thomson (Lord Kelvin) expressed this view in 1888; but it is remarked that the phenomenon has been observed simultaneously by a number of different persons; Arago collected a number of reports and Sauter recently published a complete description of 213 cases of globular lightning. Planté reproduced an analogous phenomenon experimentally, and according to him it appears to consist of glowing, rarified air and water vapor, the presence of the latter favoring the result and determining the color, which is red when much water vapor is present, and bluish when there is little; Planté concludes that it is a partial slow discharge or a discharge by influence, of the clouds whenever the electricity is present in exceptionally large quantity. More recently Mr. Lepel produced the phenomenon by means of a powerful influence machine, a description of which was published in that journal in 1890, page 487. The author concludes with a list of the points which should be observed in recording this phenomenon.

*Practical Application of Ozone.*—The Lond. "Elec. Rev.," Dec. 7, publishes a translation of the paper by Dr. Froelich, which was abstracted in the Digest, Nov. 17. In a few introductory remarks by "E. A.," that writer does not agree with Froelich on the advantages or disadvantages of ozone in rooms; an important point is to avoid an excess of ozone; it is also claimed that Froelich obtained only an infinitesimal proportion of the ozone, which would render such an apparatus practically prohibitive for commercial use; it is intimated that much higher results are obtained by modern ozone generators.

*Removal of Naevi by Electrolysis.*—A paper on this subject by Dr. Cagley, from the "Clinical Journal," is reprinted in Lond. "Elec. Rev.," Dec. 7.

*Magnetic Treatment of Zinc Ores.*—"L'Elec.," Dec. 1, abstracts briefly from "Engineering," Sept. 28, a description of a process, which has recently been applied to an ore which was too poor to be worked by any other process; the results obtained were very satisfactory, as the material separated contained 42 per cent. of zinc; the mineral thus separated is partially reduced by heat until the oxides of iron become sufficiently reduced to have magnetic qualities, after which they are treated again.

*Proceedings of Societies.*—The stenographical reports of the second annual meeting of the German Union of Electricians at Leipzig in June, is published in the "Elek. Zeit.," Dec. 6; most of the papers have already been published and abstracted; the present report contains little of interest technically.

*Movable Roof.*—A translation of the description mentioned in the Digest last week is published with illustrations in the Lond. "Elec. Eng.," Dec. 7.

*The Digest for 1894.*—During the past year there were published in this department, 2,923 abstracts and references, or about 56 per issue; the largest number in any one department was 417, the next largest being 373, under Units, Central Stations, Plants, Systems and Appliances, Measurements and Instruments. These abstracts and references are a summary of what was published in over 900 issues of journals, of which about two-thirds were published in a foreign language, thus averaging nearly 20 periodicals per week. Some important changes in this department will begin with the next issue.

## New Books.

ELECTRIC LIGHT AND POWER. Giving the Result of Practical Experience in Central Station Work. By Arthur F. Guy, A. M. I. E. E. London: Biggs & Co. 352 pages, 47 illustrations. Price, $1.75.

The author in his preface states that the object of this book is to record and explain that information only which may be termed useful practical knowledge, though in carrying out this plan the principles underlying the action of apparatus, where necessary, are discussed briefly to enable the idea to be more intelligently grasped. In the first chapter a historical account of the electric light and the dynamo is given, followed by a resume of the progress made in electric lighting traction. In the section devoted to the latter we are surprised to learn that of the 750 street railways in the United States in 1893 "by far the greater number are run by two systems, the Thomson-Houston and Sprague's, the other being run by several minor companies." A comparison of the relative advantages and cost of electricity and gas will be found of interest by those engaged in electric lighting who have occasion to use arguments on these points.

The second chapter is perhaps the most valuable in the book and deals with motive power. Here, as elsewhere throughout the volume, the questions of cost of operation are gone into extensively, and the timely subject of gas engines is particularly well treated. The third and part of the fourth chapters deal with the theory of electricity, magnetism and electrical machinery in a very elementary way. This part of the book gives little beyond the usual "primer" instruction, and therefore will interest those only who have little or no electrical knowledge, though these will appreciate the practical form in which the information is given. The fourth chapter concludes with some useful informtion on parallel working, cost and output of dynamos, and a section of a dozen pages of practical notes on running will be appreciated by the dynamoman. Chapter V, is principally on arc lighting, which is very well

treated under the heads of illuminating power, consumption of carbons, diffusion of light, fixing and trimming, and arcs in parallel. In discussing the candle-power of arcs the author states that the actual mean spherical candle-power of a 2,000-cp nominal arc is probably not much more than 500, and that of a 1,200-cp nominal arc not much above 300; we note, however, that in the comparison of gas and electric lighting he says that "a 1,200 nominal candle-power arc lamp may be said to give out 480 candle-power when a thin ground glass globe is used"—a discrepancy of about 100 per cent. if the absorption of the globe is considered. The final chapter is on the distribution of power, and while the treatment of the subject is rather perfunctory, the practical interpolations and illustrations give it considerable value.

The work seems to be based upon the note-book of an electric lighting engineer and extended by the inclusion of much matter of an elementary theoretical character more in place in the pages of a first book or primer of electricity. Aside from this, it contains much of interest and value to the electrician and engineer, and in its entirety can be recommended to those starting into practical electrical work who only care to know the simpler parts of electrical theory.

Lamp Hook.

## Lamp Socket Attachments.

We illustrate herewith a simple gas-fixture and a socket attachment, manufactured by the Independent Electric Company, 39th street and Stewart avenue, Chicago. The lamp fixture attachment illustrated is just being placed on the market under the name of the "Universal" and seems to have several specially good points. It can be readily and permanently attached to gas fixtures without breaking the gas joint, which is a very desirable feature. It can be bent in any direction without impairing its strength, and having no soldered joints, there is no danger of accident, even if fitted with a heavy shade. The neat appearance of this attachment as well as that of the socket hook, also illustrated, are in their favor, and the makers feel satisfied that they will meet with the merited appreciation from electricians.

## A Reconstructed Station.

An object lesson is contained in the accompanying two illustrations showing how electrical apparatus apparently hopelessly damaged by fire can be repaired and made practically as serviceable as new machinery. Some time ago we noted in our news columns that a fire had occurred in the works of the Attleboro Steam and Electric Company, Attleboro, Mass., and Fig. 1 shows what was left of the works the next day. Notwithstanding the fact that the makers of the dynamos claimed that they were utterly worthless, Mr. S. W. Rushmore, of the Rushmore Dynamo Works, Jersey City, N. J., took the matter in hand and the result is shown in the illustration, Fig. 2, of the rebuilt station. The plant consists of eight 50-light arc machines, one 1000-light alternator, three 90-kw and two 100-kw generators, driven by a 450-hp and a 600-hp Harrisburg engines. Mr. H. M. Dagget, manager, and Mr. John Tregoning, late superintendent of the Thomson Electric Welding Company, who have charge of the plant, also deserve much credit for the energy and judgment displayed in reconstructing the station. Owing to the usual light construction of the station buildings in this country, there is not ordinarily in case of fire sufficient heat generated to injure the heavy masses of metal employed in the construction of dynamos any more than it would the engines, which are very rarely condemned as worthless.

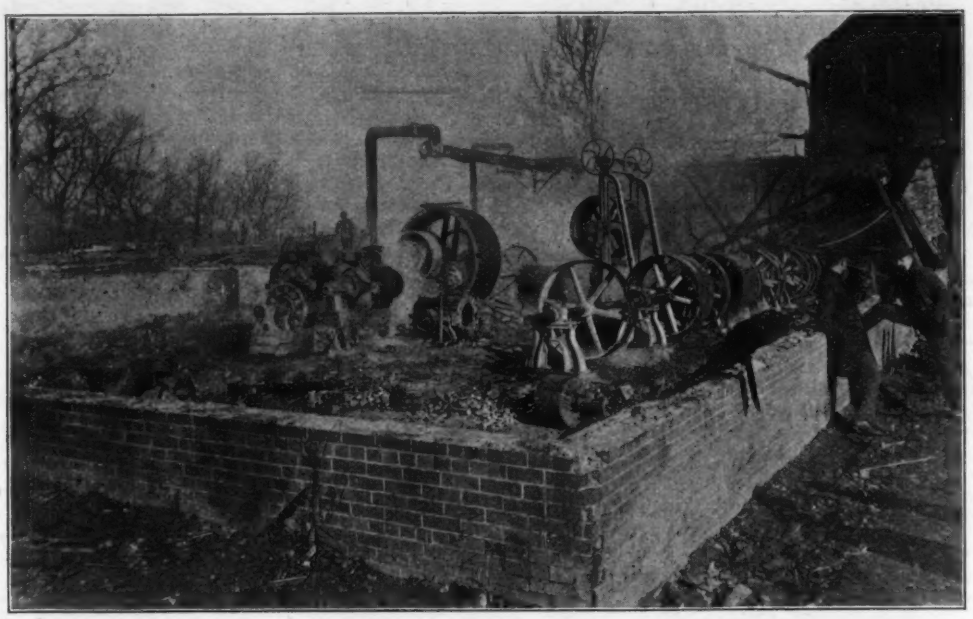


Fig. 1. Burned-Out Station.

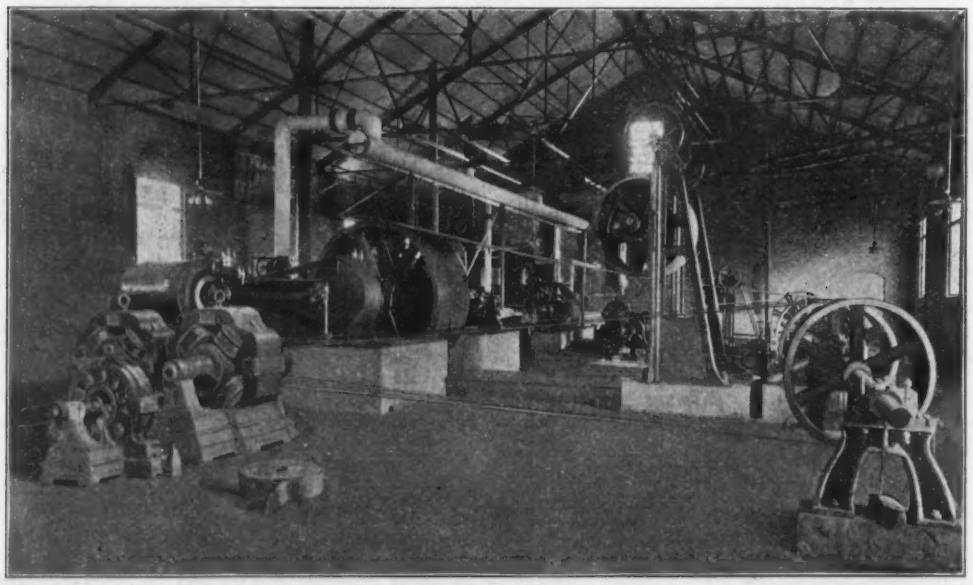


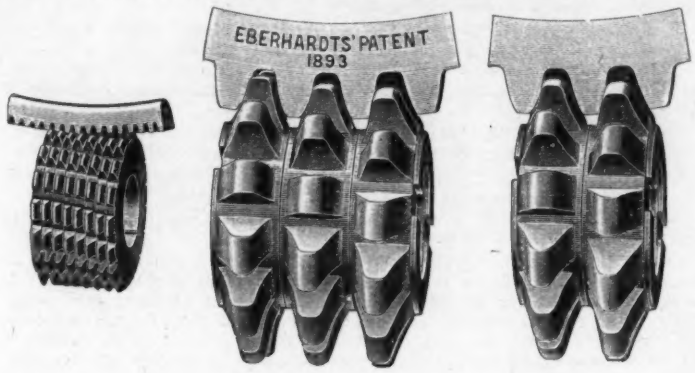
Fig. 2. Station Rebuilt.

Fixture Attachment.

## New System of Cutting Gears.

We illustrate herewith a new system of radial cutters, originated and made by Gould & Eberhart, Newark, N. J., for the quick production

of perfect cut gears. Each cutter is made individually and with relieved teeth so that they can be sharpened as easily as the regular cutters, and without changing their form. With this system, it is claimed that ten to forty inches per minute of cutting is possible. The cutters




NEW SYSTEM OF RADIAL CUTTER.

are made in gangs of from two to ten cutters, the number depending upon the pitch diameter and number of teeth in the gear to be cut. The cost of cutting gear wheels with these cutters is reduced to a minimum, and it is claimed that cut gears can with them be produced at as low cost as those with cast teeth.

## Underground Conduits and Conductors.

Mr. Allan R. Foote has taken up the subject of Underground Conduits and Conductors for all classes of electrical service, with the object of producing a book on this subject that will not only give a faithful historical statement of what has been accomplished in this country in this department of electrical development, but also give the results of experience and a clear statement of the best practice of the day, for the information and guidance of those who are yet to make investments in underground construction, and for city authorities in formulating rules and permits. In order to complete this work quickly and have it, when done, of the highest degree of practical efficiency, Mr. Foote requests all persons who have had experience, or who feel an interest in the subject, to make suggestions to him as to the plan and scope of the work and also to indicate what information, based on experience or technical information, they are willing to place at the service of the public through the medium of the book. The address of Mr. Foote is P. O. Box 685, Washington, D. C.

## New Atlas Engine.

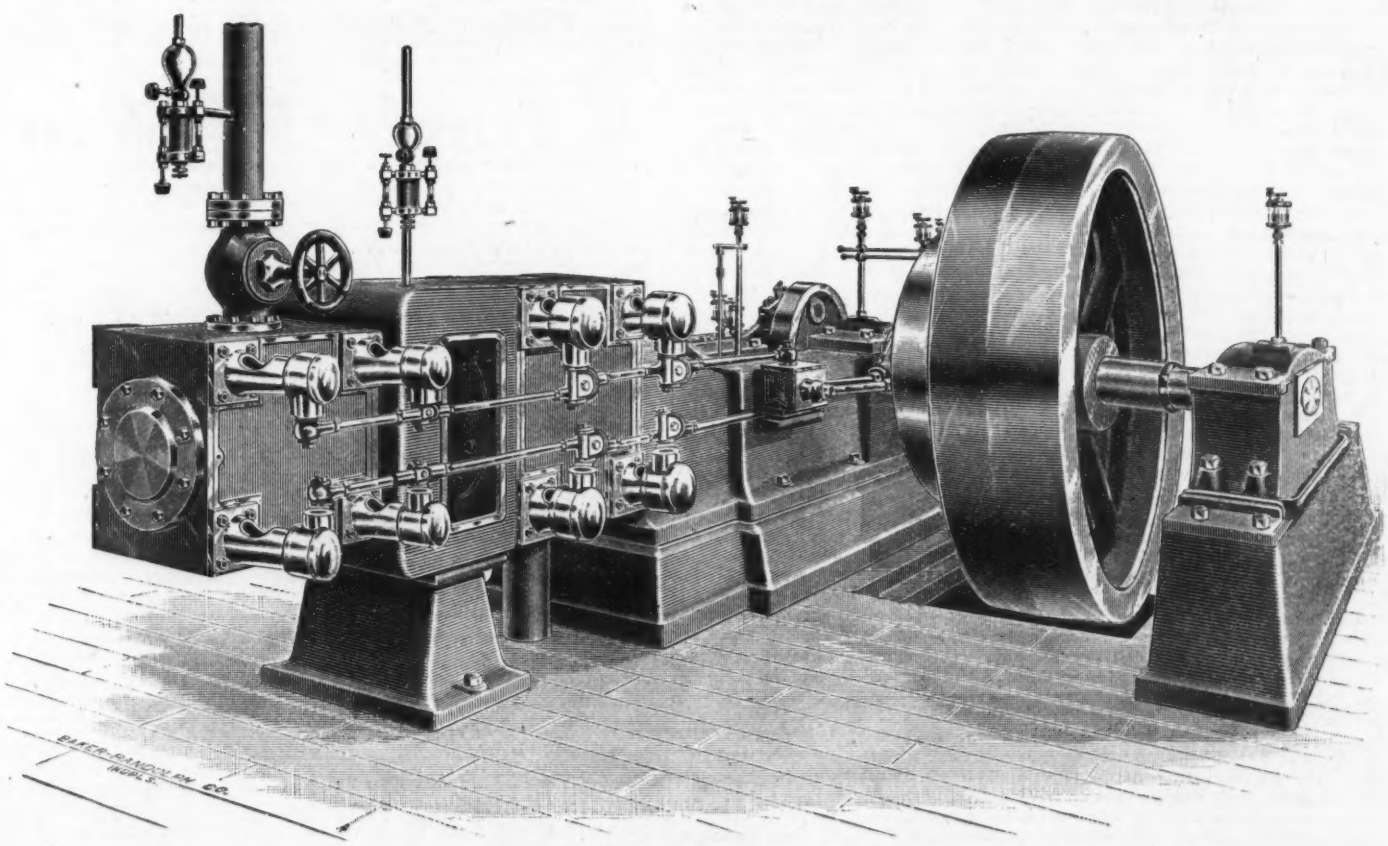
In recognition of the demand for better results in progressive steam engineering, the Atlas Engine Works, Indianapolis, Ind., has recently placed on the market a new engine, which we illustrate, under the name of the "Cycloidal Heavy Duty Engine."

The cylinder of this engine is of the four-valve type, with the shortest possible ports, and with a live steam jacket to prevent condensation. The valve seats are removable for inspection or renewal; the cylinder lining is also removable for repair or renewal, thus affording an important convenience for increase or decrease of the cylinder diameter to a reasonable degree. The steam valves are multi-ported, flat surfaced, tight wearing, quick opening and short traveling; they operate for any port opening with the least motion of a simple cycloid, are closed by steam pressure, and have no motion when under heavy pressure, and are removable for examination in three minutes' time. The exhaust valves are positive motion, multi-ported valves, operated by a fixed eccentric, and maintain a uniform compression under all load variations; they are also removable for examination or exchange of parts.

The mechanism operating the valves is stripped of all crab claws, trips and dash pots. Rods direct from the governor and two eccentrics work in lateral-motion simple cycloids for the steam valves, and cranks operate the exhaust valves. All are made of the closest steel and are free from perceptible wear; they are boxed in oil, conveniently accessible for care.

The main cross head is of the locomotive type and with abundant weight to take the impact of steam on the piston, equalize the pressure on the crank pin and diminish wear upon the piston and cylinder. The features of the valve cross head are direct connection between eccentrics and valve rods, absence of objectionable rock shafts, and diminuition of wear by the mounting of one slide upon the other; only the differential motion occurs between the two. The connecting rod is a plain, heavy strap joint rod, the strap being the special feature. No parts are strained by bending, being built up of two sides and one end piece. The tenons on the ends, equal in strength to the sides, take the entire strain; the through-going bolts merely holding the parts together.

The main bearing is removable and has a diameter equal in inches to one-half the cylinder diameter, and a length measuring the same as the full diameter of the cylinder; the frictionless journal box can be taken out for renewal by simply jacking up the shaft and wheel. The governor is a strong roller bearing shaft of the inertia or dead wheel form, and controls the light weight, non-resisting balanced valves with so little effort that there is practically no variation in speed.




CYCLOIDAL HEAVY DUTY ENGINE.

## Electric Railway Equipments.

It is possible to-day to buy a car equipment for $850, which a year ago cost $1,250, and two years ago $1,650. While the profit is, of course, now much less than formerly, yet the reduction in labor, cost of material nd management have been large factors in bringing about the decrease.

# Financial Intelligence.

## The Electrical Stock Market

New York, Dec. 22, 1894.

THE ELECTRICAL STOCK MARKET was infused with new life during this week, several of the issues of this class demonstrating that the old-time partiality of investors for them had not been quite forgotten. It has often been pointed out in these columns why electrical stocks which mainly represent manufacturing or operating companies whose business directly reflects trade conditions, should prove prime favorites with the investing class of Stock Exchange customers, and the renewed demand for these securities, at a time when the commercial soundness of the country is reasserting itself, fully bears out these assertions.

GENERAL ELECTRIC betrays no sign of weakness in the midst of the varied onslaughts on the active Stock Exchange list. The bear clique has endeavored to shake down quotations all around on what they are pleased to designate the poor outlook for business by reason of the currency straits of the Government, and the so-called "Industrial" group of stocks has been the chief sufferer from the vicious assaults of the bear contingent. But General Electric has refused to participate in any declines, and this is not remarkable when one hears the reports relative to the company's continued prosperity. There is one officer quoted as saying that the business during 1894 in street railway equipment will exceed that of 1892, which was the banner year. Various causes are put forth to explain this heavy increase in the demand over 1893. For one thing, it is possible to-day to buy a car equipment for $850, which a year ago was $1,250 and two years ago $1,650. That a car equipment can be produced at a profit for almost half of what it cost two years ago is surprising, but the great reductions in the price of labor and material, and economies introduced in manufacture, have so reduced the cost to the companies that a substantial margin of profit is afforded at even $850. But it is not likely that prices will remain very long at the present low level, and the hard-headed managers of the dozens of street railway companies contemplating changes in motive power are hastening to secure new apparatus at prices which they are realizing are sure to be greatly advanced within a few months. Hence the big demand for street railway motors. The General Electric's business in this line is steadily growing. November, generally the dullest of the year, has been the heaviest month ever experienced. Inside of sixty days the Chicago Metropolitan West Side Elevated Railroad, which has been equipped by the General Electric Company, will be running by electricity. Many roads—among them may be mentioned the Kings County Elevated, of Brooklyn, and the Manhattan Elevated, of New York—are awaiting with interest the outcome of this practical experiment. The two roads in question have made thorough examination into the cost and practicability of equipping their lines electrically, and the success of the General Electric system in Chicago will probably be followed by its introduction in the east. It is on such prospects that General Electric stock holds strong, and with reason.

WESTINGHOUSE ELECTRIC is benefiting from similar causes. Its business is uninterruptedly on the increase, although the orders on hand are in themselves sufficient to keep the works busy for a long time. A malicious attempt was made during the week to rig the stock on the Pittsburg Exchange. A raid was made on the report that the Westinghouse Electric employees had been notified that the two weeks' pay roll due last Saturday would not be paid for a week or so. Naturally there was hardly any truth in this and the fraud was discovered ere there was any chance to take advantage of the financial difficulty naturally inferred from the story. The facts of the case are these: Heretofore it has been the Westinghouse company's custom to pay every alternate Saturday; recently, however, a change was ordered in the pay day, necessitating the postponing of payments for a week. Financial considerations had nothing to do with the change, and to any one acquainted with the Westinghouse company's condition and its prospects the story was false on its face. The effect on the stock was hardly perceptible and that but for a moment.

AMERICAN BELL TELEPHONE stock broke wildly this week on the announcement that the courts had declared the Berliner patent void. The stock declined from 200½ to 191, but later rallied several points. Electrical experts insist that the adverse Berliner patent decision is a severe blow to the American Bell Telephone Company, as competitors are now able to make use of the valuable battery transmitter. The company's officials declare that the decision is only a temporary defeat. The case is to be immediately appealed to the United States Court of Appeals, where it will be argued as if it were an entirely new case. In the meantime the income of the company is not threatened, as, while the Berliner patent was a ground patent, the Bell Company has fully protected itself by specific patents on the details of exchanges. The decline in the stock has, however, complicated the matter of subscription to the new stock. Rights now have little if any value, the current market price being 11 or 12 cents. Before these rights can be transferred, stockholders must subscribe to the new shares at 190. If, therefore, the stock declines below 190, nobody will take it; this bears out the claim of the Company's officers that it is impossible to fix premiums on stock by legislation. The matter of subscriptions may, therefore, be seriously intefrered with by the new legal restrictions.

ELECTRIC STORAGE BATTERY CO., of Phila., stock continues on the uptack now that it has acquired control of the various storage battery patents. The subscription books of the company's preferred stock have been opened but it is not expected that the small stockholders will subscribe at present. If they do they are obliged to pay 50 for the preferred, which is above ruling market prices. The amount of stock now outstanding is $13,500,000 at par, of which $2,500,000 of preferred is in the hands of a trustee. It is proposed to sell $1,000,000, at par of the trusteed stock, or $500,000 and it is this issue that is now offered the stockholders and that is underwritten by the heaviest holders in the company.

EDISON ELECTRIC ILLUMINATING, of New York, has been strong on the announcement that it will show considerable more than 6 per cent. earned on the stock for the year. The only thing keeping the stock down around par has been, it is said, the liquidation of some 15,000 shares taken from General Electric during the panic of 1893, which have been coming on the market ever since the stock recovered to par. Of late, too, there has been a deal of selling of the higher-priced bonds, the believers in the property putting the proceeds in the stock. Until July 21, 1895, the bonds can be converted into stock on ninety days' notice.

THE BOSTON EDISON ELECTRIC ILLUMINATING COMPANY stockholders, as announced last week, authorized the directors to increase the capital stock from $3,000,000 to $3,425,000, the new stock to be offered to stockholders at 100, one new share for every six now held. The current quotation is 120 bid.

ERIE TELEPHONE holds its own. The company reports a net gain of 74 subscribers for November, the total connected on December 1 being 16,006.

AMERICAN DISTRICT TELEGRAPH have decided to postpone action on their dividend, until the annual meeting of the stockholders on January 24, 1895. A dividend of 1 per cent. is reported earned but it was thought wise to defer payment for the present.

THE MEXICAN TELEGRAPH COMPANY has declared a quarterly dividend of 2½ per cent., payable January 12 to stockholders of record January 5. Books reopen January 14. The company's statement shows a surplus on October 1 of $378,292 and net earnings to December 31 of $62,171. As the dividend requires $47,815 there is an addition to the surplus for the quarter of $14,356, and there will be a total surplus after paying the January dividends of $392,642.

THE CENTRAL & SOUTH AMERICAN TELEGRAPH COMPANY has declared a quarterly dividend of 1¼ per cent. payable January 5 to stockholders of record December 29. Books re-open January 7. Quarterly statement shows: surplus October 1, $541,283; net earnings for December quarter, $179,656; dividend requires $110,390; surplus for December quarter $68,866; surplus after January dividend, $610,150.

### ELECTRICAL STOCKS.

| | Par. | Bid. | Asked |
|---|---|---|---|
| Chicago Edison Company | 100 | 127 | 130 |
| Cleveland General Electric | 100 | 80 | 90 |
| East River Electric Light Co. | 100 | — | 50 |
| Edison Electric Ill., New York | 100 | 101 | 102 |
| " " " Brooklyn | 100 | 109 | 112 |
| " " " Boston | 100 | 126 | 128 |
| " " " Philadelphia | 100 | 120 | 125 |
| Edison Ore Milling | 100 | 13 | 15 |
| Electric Storage Co., Philadelphia | 100 | 39 | 40 |
| Electric Construction & Supply Co., com. | 15 | 7½ | 10 |
| " " " pref. | 15 | 7½ | 10 |
| Fort Wayne Electric | 100 | 2 | 3 |
| General Electric | 100 | 35¼ | 35⅝ |
| General Electric, pref | 100 | 67 | 70 |
| Westinghouse Consolidated, com. | 50 | 33 | 34 |
| " " pref | 50 | 50½ | 51½ |

### BONDS.

| | | | |
|---|---|---|---|
| Edison Electric Ill., New York | 1,000 | 108½ | 109 |
| Edison Electric Light of Europe | 190 | 75 | 85 |
| General Electric Co. deb. 5's | 1,000 | 91¼ | 91⅝ |

### TELEGRAPH AND TELEPHONE.

| | | | |
|---|---|---|---|
| American Bell Telephone | 100 | 190½ | 191 |
| American District Telegraph | 100 | 35 | 40 |
| American Telegraph & Cable | 100 | 91 | 92 |
| Central & South American Telegraph | 100 | 102 | 105 |
| Commercial Cables | 100 | 130 | 145 |
| Erie Telephone | 100 | 50½ | 51 |
| Gold & Stock Telegraph | 100 | 103 | 105 |
| Mexican Telegraph | 100 | 180 | 190 |
| Mexican Telephone | 100 | 75 | 80 |
| New England Telephone | 100 | 67 | 69 |
| New York & New Jersey Telephone | 100 | 97 | 98 |
| Postal Telegraph-Cable | 100 | 50 | 55 |
| Western Union Telegraph | 100 | 86⅛ | 87 |

ELECTRIC TRACTION stocks evidence increasing interest therein. This is probably due mainly to the rapid introduction everywhere of the electrical street railway, thereby making investors everywhere personally acquainted with the earning possibilities of electric traction stocks. It is commented on in a preceding paragraph how the cheapness of car equipments has resulted in a tremendous demand from all sections of the country for electric equipment for street railways. The economy of electricity as a motive power is becoming a more and more patent fact, and electric traction stocks must, with the continued introduction of electric roads, be a more and more important factor in the investment securities market.

### ELECTRIC TRACTION STOCKS.

| | Bid. | Asked |
|---|---|---|
| Union Ry. Co. (Huckleberry) | 130 | 136 |
| Brooklyn Traction pfd. | 66 | 69½ |
| " " common | 14½ | 15⅛ |
| Long Island Traction | 14 | 14 |
| Rochester St. Ry | 38½ | 40 |
| Columbus St. Ry | 45 | 50 |
| Louisville St. Ry. pfd | 87 | 88 |
| " " " common | 37 | 39 |
| Cleveland Electric Ry. | 45 | 47 |
| Cleveland City Ry. | 68 | 70 |
| North Shore Traction | 23½ | 25 |
| New Orleans Traction | 63½ | 65 |
| Worcester Traction pfd | 80 | 82 |
| " " common | 14 | 15⅛ |
| Metropolitan Traction, Philadelphia | 103½ | 1040 |
| Philadelphia Traction | 99 | 10 |
| People's Traction | 52½ | 53 |
| Binghamton R. R. common | 100 | — |

### BONDS.

| | Bid | Asked |
|---|---|---|
| *Union Ry. 1st. mtge 6s | 105 | 108 |
| *Westchester Electric 1st. m. 5s | 98 | 101 |
| Rochester St. Ry. 1st. 5s | 95 | 97 |
| *Columbus St. Ry. 1st 5s | 89 | 92 |
| Columbus Crosstown 1st. 5s | 95 | 97 |
| Binghamton Railroad Co. 5s | 99 | 100 |

*With accrued interest.

# Special Correspondence.

## NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
253 Broadway, New York, Dec. 22, 1894.

MR. FREDRICK BATHURST sailed for Europe on Saturday as the accredited representative of the owners of the British Interior Conduit patents. Mr. Bathurst was an electrical engineer in England. Afterward he came to America and held an important position for about six years at Schenectady. For the last six months he has devoted his attention to studying the processes employed in the manufacture of interior conduit tubing. It will, therefore, be seen that he goes back to England well equipped for the work he has undertaken, and he carries with him the wishes of his numerous friends in America for success.

## WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
936 Monadnock Building, Chicago,
December 21, 1894.

W. WORTH BEAN—and who doesn't know him—from across the lake, dropped in at THE ELECTRICAL WORLD office one day this week. Bean is as young as ever.

THE CHICAGO AND WORTH STREET RAILWAY COMPANY, Chicago, Ill., capital stock $2,000,000, has been incorporated by W. W. Beatty, J. H. Smith and M. Skinner.

THE MANUFACTURER'S ASSOCIATION of Cincinnati and Hamilton County, gave a very successful dinner at the Grand Hotel, Cincinnati, O., on Thursday evening, December 20.

THE SIEMENS-HALSKE ELECTRIC COMPANY says its business at the present time keeps it working night and day, and it does not see where the complaints of "hard times" come from.

THE WEBSTER ELECTRIC COMPANY, of Minneapolis, Minn., suffered loss from a fire in its store room at 11 Washington avenue N. The origin of the fire is not known. No insurance was carried. Although the loss was not great it is somewhat disheartening to a small firm in these dull times. The prospects of the company for the future, however, are bright and a good year in 1895 is expected.

THE WASHINGTON ELECTRIC COMPANY is in a quiet way building up a very handsome business. Its annunciator business alone is remarkably large for such a new firm, while its general contract business in work like manufacturing telephones, telephone switch boards and especially electric light and other devices for theatrical work, is gratifyingly large. It is one of the few places in Chicago where a man can go and have any kind of a job finished in first-class style.

THE CENTRAL ELECTRIC COMPANY, of Chicago, has placed on the market a Leclanche porous cup, having the date on which it was made stamped on the outside. Everyone using the cup will appreciate this, as it is frequently a great convenience to be able to determine why a cell fails, or to know that it has failed much sooner than it should under ordinary circumstances. Knowing the date of its manufacture it is an easy matter to determine whether the difficulty rests with the porous cup itself. The Central Electric Company is now sending out the supplements to its large catalogue, giving over 100 pages describing electric appliances.

Oregon City, Wash., Dec. 14 1894.

JAMES G. WARNER now represents the Westinghouse Electric Manufacturing Company, in Tacoma, Wash., the Portland agency having been discontinued.

MR. T. A. SHOCK, formerly district engineer of the Northwest General Electric Company in Portland, Ore., is now superintendent of the Central Electric Railway Company, of Sacramento, Cal.

SCOTT'S MILLS, ORE., now has an incandescent lighting plant in operation supplying street lights. The towns of Gervais and Dayton, Ore., have also decided to light their streets with electricity.

THE PORTLAND GENERAL ELECTRIC COMPANY has installed in "Station A," Oregon City, an additional railway generator, Edison type, having a capacity of 100-kw. The East Side Railway and the Willamette Falls Railway are operated by this station.

MR. AXEL ECKSTROM, of Lynn, Mass., who is representing the General Electric Company, of New York, has been in Oregon City lately, on business connected with the new electric station of the Portland General Electric Company at this point. He makes Portland, Ore., his temporary headquarters.

THE OREGON TELEPHONE AND TELEGRAPH COMPANY, of Portland Ore., has made arrangements, through Superintendent J. H. Thatcher, to install a telephone exchange in Oregon City. The central office will be located in the new Canfield building, and there will be about 25 subscribers the first month. Business is improving on the long distance lines of this company.

THE CITY OF PORTLAND, ORE., has just closed a contract with the Portland General Electric Company to light and heat the new City Hall, and also to operate the elevators. The contract price is $475 per month. The Portland Gas Company offered to furnish the same service for $425, but the electrical service was considered more satisfactory. There will be more than 1,000 incandescent lights in the building.

THE NORTHWEST GENERAL ELECTRIC COMPANY, of Portland, Ore. recently closed a contract to install a 300-light alternating machine of the T.-H. type, in the State Reform School in Salem, Ore. The company will supply the Willamette Pulp and Paper Company, of Oregon City, with a six-pole power generator of a special type, having a capacity of 300-hp, and designed to operate electric motors which will drive the company's paper machines.

THE NEW FIRM of electrical contractors, composed of H. C. Stevens, Jr., and C. G. Miller, have opened an office and supply house on Main street between Sixth and Seventh, in Oregon City. They also handle the supplies for the Portland General Electric Company's commercial circuits in Oregon City. The new firm has recently wired the Capen shoe factory for 60 incandescent lights, the Baptist church for 33 lights, and the Barclay building for 40 lights.

THE WILLAMETTE PULP AND PAPER COMPANY, of Oregon City, recently set in operation an electrical power installation comprising two T.-H. motor type railway generators, which supply current for a G. E. M. P. type motor having a capacity of 120-hp at 500 volts. The generators are located in the company's pulp mills about 200 yards from the motor, which is used to operate a new Pusey & Jones Fourdrinier machine just erected by Mr. Noble Heath, of Willmington, Del.

THE SACRAMENTO POWER AND LIGHT COMPANY, of Sacramento, Cal. has closed a contract with the General Electric Company, of New York, for the equipment of an electric station in Folsom, Cal., from which current will be transmitted to Sacramento, 24 miles distant. The apparatus includes four 1,000-hp alternating generators, 3-phase system, which will be directly coupled to four 30-inch Smith & McCormick horizontal turbine water wheels. Four thousand horse-power will be transmitted at 11,000 volts.

THE POSTAL TELEGRAPH-CABLE CO., which recently completed its second transcontinental route through to New York, via San Francisco, Denver and Chicago, made a test of its lines December 2. Wires were successfully worked from Portland, Ore., to New York via the new Eastern route, and back to Portland via the old route, making a continuous circuit of nearly 8,000 miles. The new route starts eastward from Mojave, Cal., while the old line follows the Canadian Pacific route after it leaves the Pacific coast system.

THE PORTLAND GENERAL ELECTRIC COMPANY recently moved into its new general office building at the corner of Seventh and Alder streets, Portland, Ore. The office building will for the present consist of one story, 45 by 100 feet, containing suites of offices arranged in the latest mode, and an 18-foot basement, which will be utilized as the distributing station for the city. The transformers from the present sub-stations will be removed to the new building, and two new rotary transformers of 500-hp each will be installed there. The present capacity of the station is 8,000-hp.

ST. LOUIS, Dec. 20, 1894.

THE HEINE BOILER COMPANY are busy as ever spreading the fame of their water tu be boilers.

THE WAGNER ELECTRIC COMPANY have one of the busiest factories to be found in the United States just at the present time. Their orders for transformers have piled mountain high, and they are working under unusual strain to keep up with the procession of requisitions constantly coming their way.

THE PLANTERS' HOTEL seems to be drawing immense crowds. Its electric lighting equipment is certainly one of the finest in the world, and does much to enhance the splendor of what may be catalogued as one of the grandest hotels ever constructed. Everything in and about the plant was supplied by the General Electric Company.

THE RANKIN & FITSCH ENGINE COMPANY, whose great engine in service at Atlanta every visitor to that city in connection with the recent convention remembers with delight, is building another monster for the city of Chicago, to go in the new power plant. This company is doing a large business with electrical equipments and build an excellent engine.

THE ST. LOUIS REGISTER COMPANY report things momentarily quiet in the register business; but they have an unusual number of inquiries on hand that will materialize into orders just after the holidays, when purchasing agents are a bit easier and not so afraid of making a big buying list for '94. The business of the company the past year has been very gratifying.

THE ELECTRIC CLUB held its annual meeting for the election of officers on the 19th, with the following result: President, Robert McCulloch; vice-president and secretary, Louis Nahm; treasurer, Capt. J. A. J. Schultz. Directors, A. S. Partridge, W. H. Bryan, W. L. Arnold, E. W. Moon, H. H. Humphreys and Col. E. D. Meier. Considerable comment was made on the fact that Mr. J. H. Rhotehamel was defeated for re-election as one of the directors.

THE AMERICAN ELECTRICAL MANUFACTURING COMPANY find business so good that they have been running night and day since September first, and have about completed arrangements for their new extension. This will more than double their present capacity, and will afford the company ample facilities for supplying their trade that now embraces all sections of the country. Mr. Louis Nahm stays at the helm and manages everything in his well known masterly style.

# News of the Week.

## TELEGRAPH AND TELEPHONE.

PAWTUCKET, R. I.—The work of building subways for telephone wires has commenced.

ROCK HILL, S. C.—The Rock Hill Telephone Company, with a capital of $5,000, has been incorporated by A. R. Smith and John G. Anderson. The company is to operate a telephone system in the city of Rock Hill and in the county of York.

ANDERSON, IND.—The American Telephone Construction Company, with a capital stock of $200,000, was organized with Charles M. Harriman, president, and Fred Bradbury, secretary. The company will construct and operate telephone plants at Noblesville, Lebanon, Bluffton, Laporte, and Anderson. The American telephone system will be used.

## ELECTRIC LIGHT AND POWER.

OWENSBORO, KY.—Bids will be received by W. F. Small for the erection of an electric light plant.

BALTIMORE, MD.—The Park Board is considering the question of an electric light plant of its own.

CEDARBURG, WIS.—J. W. Reader has been granted a franchise to construct an electric light and power plant.

WEEDSPORT, N. Y.—Mr. Burritt will erect a magnificent opera house in the spring, to be lighted by electricity.

SOUTH HAVEN, MICH.—The citizens will vote Dec. 17th, on the question of issuing bonds for establishing an electric lighting plant.

OSCALOSA, IOWA.—The Oscalosa Electric Light plant caught fire from the boiler room, and the entire plant, valued at $30,000, was consumed.

LONG ISLAND CITY, N. Y.—The Electric Illuminating & Power Company have been awarded the contract for lighting the streets by electricity.

BOSTON, MASS.—The Boston Electric Light Company is to erect a four story brick addition, 40x50 feet, to its plant on Head Place, to be used for storage purposes.

BALTIMORE, MD.—Officers of the C. & O. canal are discussing the plan of equipping the canal with electricity as a motive power. Will cost nearly $3,000,000.

JACKSONVILLE, FLA.—A committee of two members of the City Council has been appointed to visit two other towns where they have electric lights, and report on the advisability of erecting a plant here.

LESTERSHIRE, N. Y.—At the last meeting of the tax payers of the village of Lestershire, it was decided to have electric lights in that village, and the contract was let to the Binghamton General Electric Company, of Binghamton.

PORTLAND, ME.—The Tremont Improvement Company has been organized at Portland for the purpose of building and operating electric light, heat and power plants and supplies of electric railways, with a capital of $1,000. The president is E. F. Thompson, of Portland.

HASTINGS, PA.—Thomas J. McHugh, of Houtzdale, visited the town to look over ground preparatory to establishing an electric light plant, which he will erect here by February 1, 1895. He has no doubt that he can secure contracts for 400 lights, the number necessary to begin with.

CHICAGO, ILL.—Bids will be received until Dec. 27, for the purchase of eight dynamos and 175 arc lamps, as per specifications in the office of the Superintendent of City Telegraph. Each proposal must be accompanied by a check for $500. H. J. Jones is Commissioner of Public Works.

CHICAGO, ILL.—Mayor Hopkins, Comptroller Jones, and City Electrician Barrett held a conference recently to consider bids for dynamos at the new electric light station, at Harrison street and Blue Island avenue. There was objection to the bids received, and it was decided to re-advertise.

TAMPA, FLA., is in favor of owning its own electric light plant. A council committee has found that the city could put in dynamos and a power plant for $15,000, but it recommended that only the wires, poles and lamps be set up now, and to advertise for bids to light the city for two or more years.

THE CITY OF MELBOURNE, Australia, requests tenders for the supply of an electric light plant, and in order to afford facilities for those interested, has forwarded to the office of THE ELECTRICAL WORLD specification sheets, copies of which may be had upon application by the prospective bidders.

WASHINGTON, D. C.—The Treasury Department is inviting proposals until January 3, 1895, for manufacturing and placing in position in the United States building at Cedar Rapids, and Fort Dodge, Iowa; Lowell, Mass.; Sheboygan, Wis., and Sioux Falls, S. D., combination gas and electric light fixtures. Additional particulars may be obtained by addressing C. S. Hamlin, acting secretary of the treasury.

ALBANY, N. Y.—At a meeting of the Common Council, Alderman Wagner presented a resolution accepting a proposition to have a special committee named, consisting of the president and four members, who shall report the cost of maintaining and establishing a light and power plant complete, to be owned by the city, which in addition to furnishing the necessary street lighting and such power the city may need, shall also furnish light and power for general purposes.

## THE ELECTRIC RAILWAY.

HOT SPRINGS, S. DAK.—The City Council has granted a franchise for an electric railway.

PALMYRA, N. J.—The West Jersey Traction Company has been granted the right of way through the town. The company will maintain ten arc lights on its line witin the city limits.

MATAMORAS, PA.—An electric road will be built in this place without doubt. Mr. Warren K. Ridgway is interested.

FORT WAYNE, IND.—General Manager M. S. Robinson, has decided to equip all the street cars with electric headlights.

WOODBURY, N. J.—The Camden, Glucester & Woodbury Railway Company has obtained a franchise to lay a street railway.

ADOLPH SUTRO hopes to obtain permission to electrically equip his street railway line to Sutro Heights, in San Francisco.

PORT COLBORNE, CAN.—Leonard McGlashen and others have formed a company to build an electric railway from Port Colborne to Fort Erie.

NORWICH, CONN.—The Street Railway Company will petition the Legislature to extend its Laurel Hill branch to the residence of Jonathan F. Lester.

JACKSONVILLE, FLA.—It is said that the Fairfield road will be extended to Bucki's mill, and return to the city by way of the old line. This will make a belt line.

REVERE, MASS.—Residents of Beachmont and Crescent Beach are about to petition the West End Railway to extend its route from East Boston ferry to their homes.

BALTIMORE, MD.—The Traction Company will equip the Gilmore street line with electric power. Contracts have been awarded, and it is expected to be finished by January 15.

ELKHART, IND.—Elkhart citizens are petitioning the city Council to compel the Electric Railway Company to use iron trolley posts through the business portion of the city.

WALDEN, N. Y.—The Walden & Orange Lake Electric Railway has been granted permission to construct and operate an electric railway in the town of Montgomery and the village of Walden.

LEWISTON, ME.—It is said that a syndicate will ask the next Legislature to grant a charter for an electric railway from this city to Augusta via. Sabattus, Leeds, Monmouth, Winthrop and Manchester.

BRISTOL, CONN.—The Bristol & Plainville Tramway Company has asked permission to lay tracks in certain streets of the city. The Selectmen do not approve of it, and another hearing is to be held.

LEOMINSTER, MASS.—There is a movement on foot to bring about a plan to have the tracks of the West Street Electric Railway, when constructed, laid through Park street instead of on the north side of the common.

SENECA FALLS, N. Y.—The Board of Highway Commissioners is considering the application made by the W. S. F. & C. L. Railway Company for permission to construct a railroad on the new boulevard to the lake.

HUDSON N. Y.—At a meeting of the Common Council the Hudson Electric Railway Company asked permission to construct, maintain and operate a street surface railway with electricity as motive power in certain streets of the city.

TYNGSBORO, MASS.—The Lowell & Suburban Street Railway Company has petitioned the selectmen of Tyngsboro for a location to extend its electric road through that town to the New Hampshire line on the border of the town of Hudson.

SENECA FALLS, N. Y.—The Board of Trustees will consider the application made by the Waterloo, Seneca Falls & Cayuga Lake Railway Company for permission to construct and maintain an electric railway on Fall, Ovid, East Bayard and Stevenson streets.

BATAVIA, N. Y.—The Batavia & Northern Railroad Company has been incorporated, with a capital of $326,000, to construct a railroad 18 miles long, to be operated by steam or electricity, between Albion, Orleans County, and Batavia, Genessee County.

PORTLAND, ME.—The Legislature will be asked this winter to charter an electric railroad to run from some point in the city of Portland along the cape shore for 15 miles. The petitioners are F. Coleman Boyd, of New Haven, Conn., J. S. Winslow, and others.

READING, PA.—The Mohnsville and Adamstown Electric Railway has nearly completed its line, which is seven miles long and is practically an extens on of the Reading and Southwestern Street Railway, although constructed under a separate charter.

NYACK, N. Y.—A conference of the parties interested in starting a trolley line to run from Sparkhill, through Nyack, to the Hook Mountain, was held, and it is said that the project was abandoned for the present at least. R. H. M. Dickinson, of Nyack, is interested.

WEST NEW BRIGHTON, N. Y.—The S. I. Midland Railway Company has been consolidated with the P. R. & P. P. Electric Railway Company, under an agreement whereby an extension will be built from Castleton Corners over the Richmond turnpike and Jewett avenue to Prohibition Park.

MEDIA, PA.—The representatives of the Delaware County and Philadelphia Trolley Company and the street committee have held a conference, and permission was given to the company to lay its tracks on Washington street, as far as the tracks of the Chester and Media Trolley Company.

ROCHESTER, N. Y.—The Rochester Railway Company has made application to the Board for its consent to the construction, location, maintenance and operation of its railroad, tracks, poles, wires and other appliances in, through, along and upon the streets of the city. The application will be considered.

ATLANTA, GA.—Notice has been given that the following gentlemen will apply at the next regular meeting of the Council for a franchise to build and operate an electric street railway along and over certain streets of the city. W. A. Hemphill, Geo. S. Lowndes, A. J. McBride, Woodford Brooks, J. T. Voss.

NYACK, N. Y.—J. Hull Downing, President of the Northern New Jersey Railroad, will build a trolley road from the Nyack station of the Northern road to the Hook Mountain, or will extend the latter road and run a "dummy" on it as frequently as the people desire it, if the right of way can be secured without trouble or litigation.

NORFOLK, MASS.—The Norfolk Suburban Street Railway Company has completed its line from Readville to Forest Hill, a distance of five miles, and cars are running. It cost $29,000 per mile to build the 2¼ miles of track within the Boston city limits, and $12,000 per mile to build the 2¾ miles in the limits of Hyde Park.

NYACK, N. Y.—There has recently been much talk about the opening of a trolley line to Nyack, both from Sparkhill and the West Shore Railroad, but the matter has not taken any definite shape until this week. Now plans are being carefully considered, and it is expected that something more positive will be known about the project soon.

SIDNEY, O.—The Sidney Electric Railway Company, capital stock $100,000, will build a road through the village of Sidney, Shelby County, and westerly to the village of Laramie, and northerly to the village of Minister, Anglaise County. The incorporators are Charles Timmes, John Laughlin, J. H. Thedieck, William Piper, and John H. Wagner.

WETHERSFIELD, CONN.—The Hartford Street Railway Company will petition the Legislature for an amendment of its charter authorizing it to extend its lines in any of the highways of the town of Wethersfield, and to strike out the word "horse" in those sections of its charter relating to the making of contracts and leases with other "horse" railroads.

KINGSTON, CAN.—C. P. Gildersleeve, Kingston, president of the projected Kingston and Ottawa Railway Company, in Ottawa, says that the proposal to make the road an electric railway is now being considered by Mr. Drummond, of Montreal. No decision has been reached, because the question of operating long distance railways by electricity is as yet an unsettled one.

TOTTENVILLE, S. I., N. Y.—President J. Frank Emmons, Superintendent F. S. Gannon, and others connected with the Rapid Transit Railroad Company, attended a meeting of the Tottenville trustees recently, for the purpose of inducing the trustees to grant permission to the company to extend the tracks of the Staten Island Railway, at Tottenville, to the foot of Bentley street.

EASTHAMPTON, MASS.—William P. Latham, of Northampton, who has the contract for an electric road across the meadows, has commenced work. On account of the land of the railroad corporation being involved in the question of a new road from the Boston and Maine depot to King Bros.' silk mill, a hearing will have to be held before the County Commissioners before this road can be laid out.

MASSENA, N. Y.—Outside parties have been at work making a survey of the route from the Rome, Watertown & Ogdensburg depot at Massena to Dodge's Landing for a surface railroad, to be run by electricity. The object of the work and proposed lines it is not definitely known, but conjectured that the New

York Central desires to connect at that point with a line of steamers on the St. Lawrence.

ROCKVILLE, CONN.—The trustees of the Hartford, Manchester & Rockville Electric Railway voted to complete the survey of the road from Manchester to Rockville early in the spring. The company expects to have cars running to Rockville by next fall. Another company has capital secured to build an electric road from Rockville to Stafford Springs, as soon as the Hartford road is completed to this city.

AKRON, O.—Handsome summer resorts will adorn the banks of Turketfoot Lake and the West Reservoir. Frank A. Seiberling, acting for the Akron Street Railway Company, was granted permission by the State Board of Public Works, at a session of that body in Columbus, to use these State lands, and as soon as the proper franchise can be secured the construction of an electric line to these points will be commenced.

PHILADELPHIA, PA.—The entire length of Market street is now at the disposal of the Philadelphia Traction Company to introduce electric conduits preparatory to erecting a trolley system, as the Highway Commissioners Supervisors granted them permission to open streets from Twenty-third street to the Delaware river. The Manayunk and Roxborough Passenger Railroad Company have asked permission to lay tracks on Ridge avenue.

PROVIDENCE, R. I.—The electric railway connecting Attleboro with North Attleboro and Plainville, which has been idle for nearly a year, owing to the destruction of the power house and to litigation, was sold at auction for $51,000, on a foreclosure sale, the mortgage being $50,000. The purchaser was a syndicate composed of Marsden J. Perry, of this city; Lyman B. Goff, of Pawtucket; Clarence L. Watson, of Attleboro, Mass, and H. F. Barrows, of North Attleboro, Mass., and other well-known and wealthy men. The road will be immediately equipped and put into operation.

## MISCELLANEOUS NOTES

THE NORTHWESTERN ELECTRICAL ASSOCIATION will hold its next convention at Milwaukee in January.

DR. PAUL SCHOOP is translating into German Prof. H. S. Carhart's book on primary batteries. The translation will appear in the spring with an additional section on primary batteries.

MR. FRED. W. DEGENHARDT died at Chicago on Dec. 7, after a brief illness. Mr. Degenhardt was the Chicago manager of the Standard Underground Cable Company, of Pittsburgh, and had many friends in the electrical field.

THE BROOKLYN ELECTRICAL SOCIETY has made arrangements with several prominent electricians to deliver lectures during the season commencing January 1. Members of the Brooklyn Engineers' Society will meet with the Electrical Society. Mr. Arthur A. Fish is secretary.

THE EDISON ELECTRIC LIGHT COMPANY, of Philadelphia, has arranged for a series of thirteen practical talks to be given in the lecture room of its station, 908 Samson street. The programme covers a wide range of practical subjects, and contains the names of men well-known in the electrical field. The idea is an excellent one and its execution will reflect much credit upon the company.

THE EDISON PHONOGRAPH PATENT DISPUTED.—Judge Lacombe, in the United States Circuit Court, on December 21, heard arguments upon the application of the American Graphophone Company against Cleveland Walcutt and others, for a preliminary injunction to prevent the defendant from selling or using the Edison phonograph on the ground that its manufacture is in violation of the American Graphophone Company's patents. The motion was argued by Lawyer Mauro, and it was claimed that the patents used in the phonograph which Edison has violated are "the sound record for sound waves and variations, a recording tablet and a tubular self-sustaining tablet for recording sounds or vibrations." Lawyer Dyer, on behalf of Mr. Walcutt, contended that there was no violation. Judge Lacombe took the briefs and reserved decision.

# Trade and Industrial Notes.

THE CLINTON WIRE CLOTH COMPANY, Clinton, Mass., have just completed a new boiler house. The roof is of iron, covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron.

MR. JOHN MACCORMACK has severed his business relations with the Sterling Company, and will hereafter practice as a consulting engineer at 126 Liberty street in engineering or other expert mechanical work.

THE PHENIX ELECTRIC SUPPLY COMPANY, of Warren, O., has been incorporated by W. B. Swager and others to manufacture and deal in incandescent lamps and other electric supplies, and to supply electric power and light.

CHAS. A. SCHIEREN & COMPANY, 45-47 Ferry street, New York, have received a letter from the Hartford & West Hartford Railway Company, Hartford, Conn., saying that the twenty-four-inch perforated electric belts recently supplied them, are giving good service, and are very satisfactory.

J. JONES & SON, 67 Cortlandt street, New York, have issued a neat little expression of Christmas greeting, accompanied by a card, on which is tied a miniature paper bag from which protude a pair of turkey's legs, and along side of which is printed "Don't miss the stuffing." On the reverse side of the card is printed a wish bone.

MR. J. W. GODFREY, of 15 Cortlandt street, New York, room 38, has accepted the position of sales agent of the well-known Habirshaw wires manufactured by the India Rubber and Gutta Percha Insulating Company. Both Mr. Godfrey and Habirshaw insulation are so well known among electrical companies that both the company and Mr. Godfrey are to be congratulated.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., has secured from the Naugatuck Malleable Iron Company, at Naugatuck, Conn., the contract for its new annealing room. The building will be 94 feet wide and 175 feet long, constructed entirely of fire-proof material. It is also building a new gas house roof for the Massachusetts Reformatory at Concord, Mass., and furnishing the iron work for the new office building of the Pope Manufacturing Company, at Hartford, Conn.

THE ELECTRIC ENGINEERING AND SUPPLY COMPANY, Syracuse, N. Y., has issued an 80-page catalogue devoted to electric light and street railway supplies. With very few exceptions the numerous articles described and illustrated are made by the company, and most of them are recognized as standards in American practice. We note a very large variety of porcelain goods, all of which are made from the celebrated Syracuse porcelain. Switches take up about half of the pages of the book, and of these almost every known form has its representative.

MR. LEMUEL WILLIAM SERRELL electric street railway contractor and engineer, Postal Telegraph Building, New York, has published a little pamphlet containing a quantity of useful electric railway data. The object of the book is to give data for the construction and operation of street railroads in such a form as to be intelligible to those who are not specially acquainted with this class of work. The matter is classified under the various heads of track and overhead construction, the car house, the power station, the equipment and the operation, with further classifications under each of these subjects. Throughout the pamphlet are illustrations of plants, etc., installed by Mr. Serrell.

THE FOSTER ENGINEERING COMPANY, Newark, N. J., has received a letter from Mr. A. S. Brown, the electrical engineer of the Western Union Telegraph Company, to the following effect: One of your four-inch "New class W. Regulators," placed in our dynamo room some six weeks ago, has been subjected to a series of carefully noted tests in actual service, and I am gratified to say the result is highly satisfactory. Steam is supplied through it to three engines, two of which are constantly running, driving with intermediate shafting forty-three dynamos. These dynamos furnish current to all the wires of this company running out of New York. Our tests show that under all conditions of varying initial steam pressure and of change of load there is practically perfect pressure regulation."

THE AMERICAN ELECTRICAL WORKS of Providence, R. I., is particularly happy in its advertising conceits, and the latest one is fully in line with previous successes. It consists of a card on which is mounted an envelope case around which, under the caption "All Comparisons are Odious," is printed the following: "Yet we must say that among our customers one only has first place in our esteem. We have (at great expense) secured a portrait (in colors) of our honored friend. We present it to you as a model. Study the features; see in this genial face how candor, joy, mirth and beauty are tempered by wisdom, justice and peace. Merit demands recognition. What we say of the original of this apotheosis of art is only justice. Upon opening the flap of the envelope we find—a mirror.

W R. FLEMING & COMPANY, 203 Broadway, New York, and 620 Atlantic avenue, Boston, representing the Harrisburg Foundry and Machine Works, Harrisburg, Pa., report the following sales made during the past few weeks: For the American Surety Company's new building, New York City, two 150-hp Ideal engines direct connected to two 100-kw dynamos, one 80-hp direct connected to 50-kw and two 50-hp direct connected to two 20-kw dynamos; for Edward J. Berwind's residence, New York City, one 50-hp Ideal engine; Norwalk Street Railway Company, South Norwalk, Conn., one 150-hp Ideal engine for electric railway service; exported to South Africa one 100-hp tandem compound Ideal engine; Yugo Isabel & Company, Guantanamo, Cuba, one 30 and one 40-hp Ideal engine; Northport Electric Light Company, Northport, N. Y., two 100-hp Ideal engines and two 100-hp Harrisburg boilers with complete steam plant work; Albemarle Hotel, New York City, two 50-hp engines direct connected to two 25-kw M. P. dynamos; Fairfield Copper Co., Monroe, Conn., one 20-hp Ideal engine; Castle Square Theatre, Boston; two 50-hp and one 25-hp direct, connected to two 100 and one 25-kw dynamos; Keith's Theatre, Boston, three 150-hp direct connected to three 100-kw dynamos; Union Street Railway, New Bedford, Mass., one 500-hp compound engine and two 250-hp Harrisburg boilers and complete steam plant, for railway service, second order; Carpenter & Tremaine, Campbello, Me., one 20-hp Ideal engine; Amherst College, Amherst, Mass., one 80-hp Ideal engine; The Belknap Motor Company, Portland, Me., one 30-hp Ideal engine; Hartford City Gas Light Company, two 30-hp engines; The L. Candee & Co., New Haven, Conn., one 150-hp direct connected to two 50-kw M. P. dynamos; Bolkenhayn Apartments, New York City, one 130 and one 50-hp direct connected to 25 and 75-kw MP dynamos; Wharton & Williams, Newark, N. J., one 50-hp Ideal engine; O. B. Stillman, Boston, one 20-hp Ideal engine; General Electric company, Schenectady, N. Y., one 50-hp for direct connecting to a 25-kw M. P. dynamo; one 200-hp Harrisburg boiler (third order) for H. W. Johns Mfg. Co., South Brooklyn, N. Y.

# Business Notices.

WOVEN WIRE BRUSHES.—The Belknap Motor Company, of Portland, Me., are the patentees and manufacturers of the best woven wire commutator brush on the market.

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

A RAILROAD DOCTOR'S PRESCRIPTION.—General Western Agent C. K. Wilber, of the Lake Shore & Michigan Southern Railroad, with headquarters at Chicago, is, without trying, one of the really funny men of the railroad world. The other day, for example, he accomplished this advertisement, which old hands at the business truly say is one of the brightest little things ever put on paper:

R

The Lake Shoe Limited taken regularly on your Eastern trips will prevent that tired feeling so often experienced by travelers.
Leaves Chicago, V.XXX P. M.
Arrives New York, VI.XXX P. M.

C. K. WILBER.
Can be taken without shaking. W. P. A.

General Passenger Agent Daniels says that Dr. Wilber's prescription is equally efficacious on trains of the New York Central, he having this assurance from Drs. Cosby and Dumond, who have tried it with perfect success. General Passenger Agent Fee, of the Northern Pacific, has offered to all his local agents and subordinates a handsome prize in money for the best advertisement of the line, and it is obviously well for them that Mr. Wilber "isn't in it."—*Brooklyn Standard-Union.*

# Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED DECEMBER 18, 1894.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

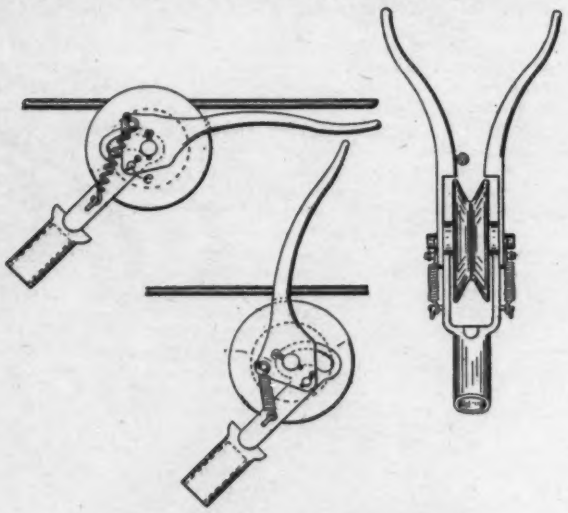
530,654. TROLLEY WIRE FINDER; F. F. and W. S. Muer, Newark, N. J. Application filed March 14, 1894. The combination of the trolley pole and wheel, with a trolley wire finder mounted on the pole, and fenders also mounted on the pole.

530,951. ELECTRIC CONDUIT; T. T. LaPointe, J. H. Flanagan and C. A. Thompson, New Haven, Conn. Application filed November 23, 1893. This comprises two head plates, one provided with a plurality of male, the other with a plurality of female fittings.

530,956. HAND OPERATING MECHANISM FOR ELECTRIC LOCOMOTIVES. A. W. Mitchell, Boston, Mass. Application filed April 14, 1892. The combination of the brake rod, gear secured thereto, a rack bar engaging with the gear, a rod turning in bearings arranged to be connected to the rheostat or controller of the motor and a gear secured to the latter rod engaging with the rack bar.

530,957. FINGER BOARD TELEGRAPH KEY; E. E. Mullinix, Burlington, Kan. Application filed July 31, 1894. The combination of a series of independently revoluble telegraphing wheels provided with peripheral symbol projections, and a single continuous movable press rod normally held in contact with the peripheries of all of the wheels and arranged to work over and onto a separate telegraph circuit or circuit closing key.

530,975. CIRCUIT CLOSER FOR BURGLAR ALARM SYSTEMS; A. Stromberg, Chicago, Ill. Application filed May 24, 1894. This comprises the covering of an opening, a pair of electrically connected plates thereon, a pair of plungers adapted to make contact with the plates and to be depressed when the covering is closed, and contact springs adapted to be engaged by the plungers in the depressed positions thereof.



No. 530, 654—Trolley Wire Finder.

530,976. BURGLAR ALARM SYSTEM; A. Stromberg, Chicago, Ill. Application filed May 24, 1894. This comprises a protective circuit, a series of plugs and sockets for completing same, the plugs being provided with a grounded normally insulated terminal, and a testing battery and signal device adapted to be connected in circuit to determine the presence and location of faults in the circuit.

531,005. ELECTRIC CONVERTER; F. C. Priestly, San Francisco, Cal. Application filed February 16, 1884. The combination of a case, and a cut-out box set in top of and extending into the case.

531,018. SIGN ADVERTISING MACHINE; O. P. Briggs and W. R. Patterson, Chicago, Ill Application filed January 26, 1894. The combination with lamps arranged to form words or characters and adapted to be successively lighted, of an automatically actuated pointer adapted to trace the words or characters as the lamps are lighted.

531,025. DANGER SIGNAL AND LOCK FOR SWITCHES; G. E. Edward's Brantford, Canada. Application filed June 16, 1894. The combination of a semaphore bell on the train, electrical connections whereby when the bell is operated the semaphore is set at danger, and connections from the semaphore to a lever on the platform whereby the rails must be locked against movement before the semaphore can be removed from the position of danger.

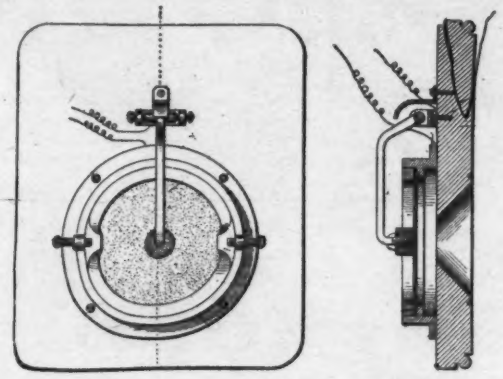
531,070. CONTROLLING DEVICE FOR ELEVATORS; A. B. See and W. L. Tyler, Brooklyn, N. Y. Application filed August 24, 1894. An elevator provided with a normally open-circuited shunt-wound motor, a controller on the car, connections for closing the circuit when the controller is operated and gradually increasing the speed of the motor, and a circuit closing device on the elevator for gradually varying the resistance of the field-magnet circuit.

531,077. COUPLER FOR ORGANS; C. Wales, Detroit, Mich. Application filed February 10, 1894. A coupling device comprising an electric circuit having movable terminals, and means for holding the terminals out of the path of the switch.

531,078. TELEPHONE SPEAKING TUBE SYSTEM; T. C. Wales, Jr. Application filed April 7, 1894. This comprises a plurality of stations and circuits, and a common source of current, switching and calling devices at each station, an electro-magnetic retardation coil in a branch conductor, and a call bell in the signaling circuit which is normally a derived circuit around the said electro-magnetic retardation coils.

531,143. APPARATUS FOR ELECTRIC HEATING, SMELTING AND SEPARATING; J. W. Woodfolk and J. C. Wharton, Nashville, Tenn. Application filed December 12, 1893. The combination with the furnace forming one electrode, through which acidulated water is circulated, of the other electrode, through which the material to be melted is passed, an exhaust fan connected to this electrode, and suitable connections for both electrodes.

531,146. SIGNAL LAMP FOR ELECTRIC RAILWAY CARS; C. H. Baker, Detroit, Mich. Application filed April 24, 1894. The combination with a rotary support of a trolley arm, of a signal lamp carried by the support.



No. 531,194.—Telephone Transmitter.

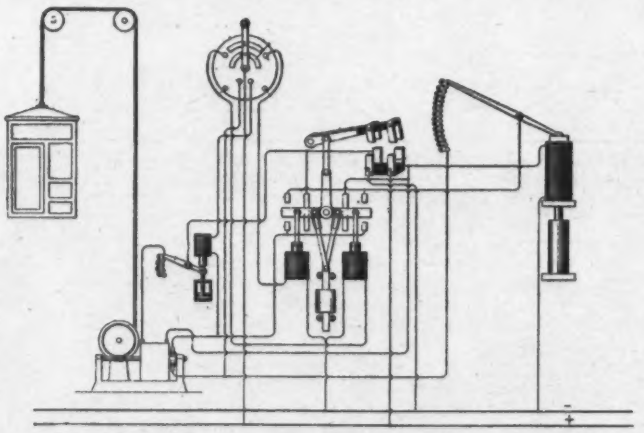
531,153. ELECTRIC METER; T. Bruger, Bockenheim, Germany. Application filed June 22, 1894. This comprises a rotary metallic body adapted to be rotated when subjected to intersecting alternate current fields with shifted phase.

531,188. SOUNDER; F. F. Howe, Marietta, O. Application filed January 15, 1894. This comprises separated cores, coils therefor, and a movable cross bar for connecting the cores at different points.

531,194. TELEPHONE TRANSMITTER; D. A. Kusel, St. Louis, Mo. Application filed August 6, 1894. This comprises a diaphragm holder, diaphragm, and clamping screws, the screws being adapted to be moved toward each other, a clamping ring adapted to be engaged by the screws to be forced into contact with the diaphragm, and an electrode adjacent to the diaphragm, and suitable connections.

531,214. ELECTRIC SAFETY APPLIANCE FOR RAILROADS; E. L. Orcutt, Somerville, Mass. Application filed November 2, 1893. This consists of electric circuits composed of the rails of the track and contact plates, a train mechanism consisting of a plurality of closed circuits, switching brushes to loop the track circuits into the train circuits and mechanism operated by the breaking of the circuits to automatically stop the train.

531,268. BRAKE AND POWER CONTROLLER FOR ELECTRIC CARS; A. W. Mitchell, Boston, Mass. Application filed January 22, 1894. This comprises a gear on the brake rod, a projection on the gear, a rack bar sliding in guide ways engaging with the gear and with the projection, and a rheostat arranged to be connected to the rack bar.



No. 531,070.—Controlling Device for Elevators.

531,284. ELECTRIC BLOCK SIGNALLING SYSTEM; A. J. Wilson, Port Chester, N. Y. Application filed May 14, 1894. This comprises a controlling circuit, track circuit controlling same, and a switch indicator connected in a bridge across the signal circuit, whereby the operation of the track circuit affects both the signal circuit and the indicator.

531,291 GUIDE FOR TROLLEY-WHEELS; W.H. Dickerhoof, Cincinnati, O. Application filed July 23, 1894. A trolley having its bearings capable of a vibratory movement thereon independent of the bearings, guide arms connected to the axis and pivoted to the bearings, and a yielding connection between the guide arms and bearing supports.

# THE ELECTRICAL WORLD

AN ILLUSTRATED WEEKLY REVIEW OF CURRENT PROGRESS IN ELECTRICITY AND ITS PRACTICAL APPLICATIONS

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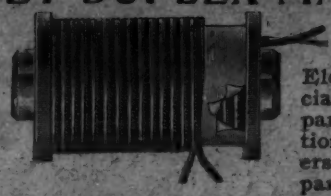

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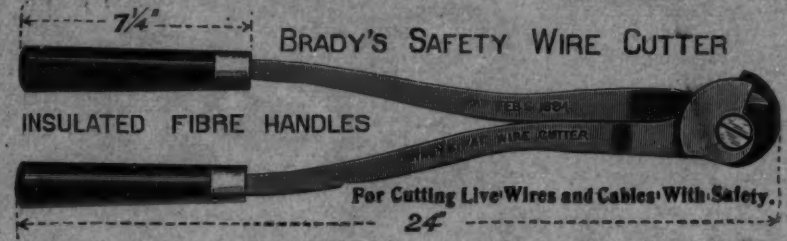


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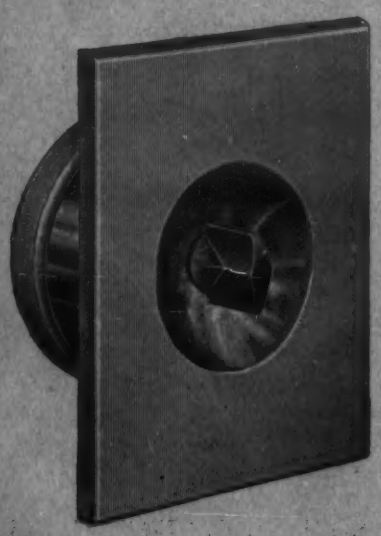

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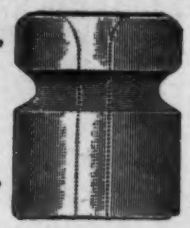

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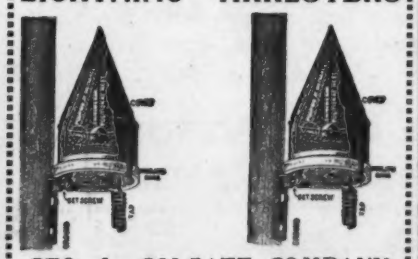

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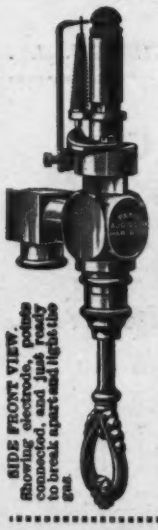


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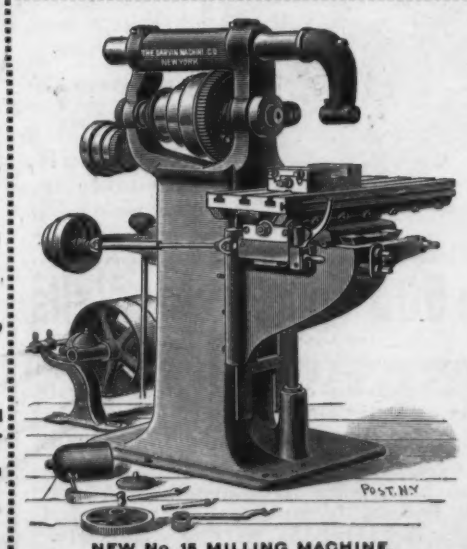


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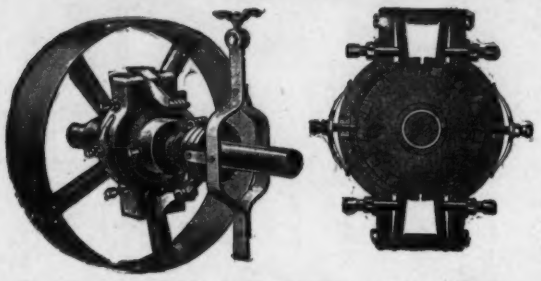

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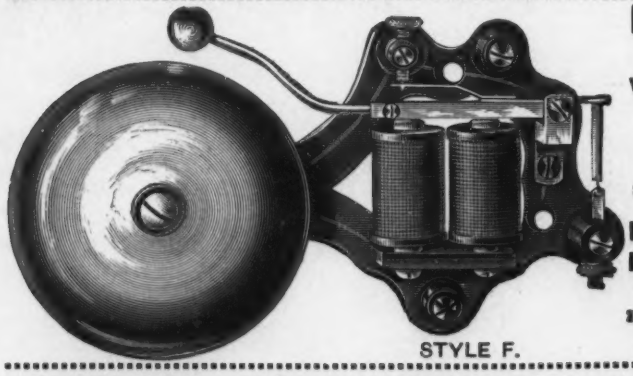

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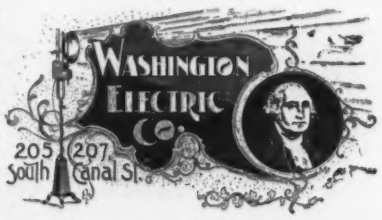


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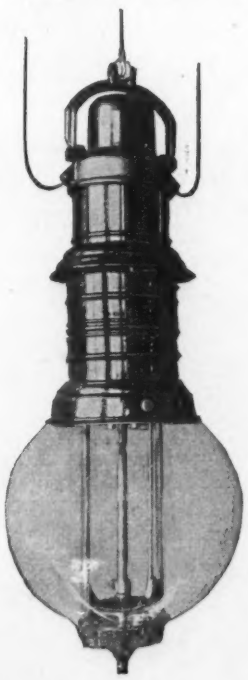

No. 10.
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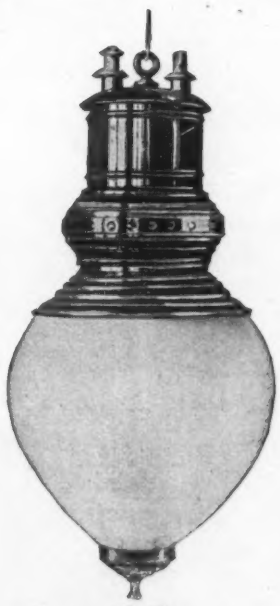

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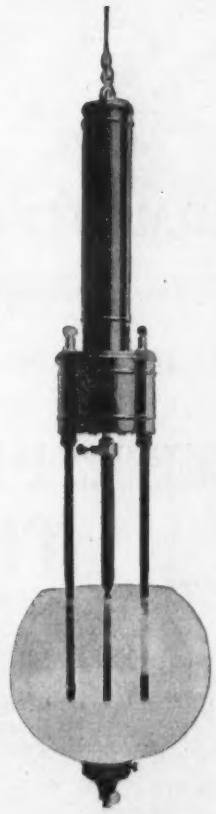

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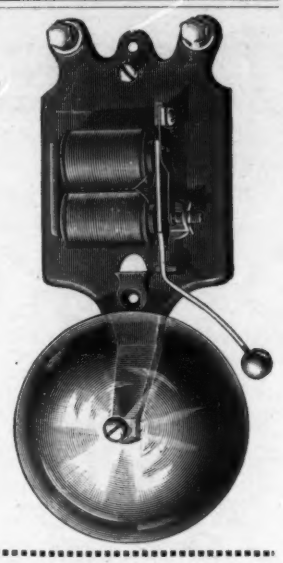

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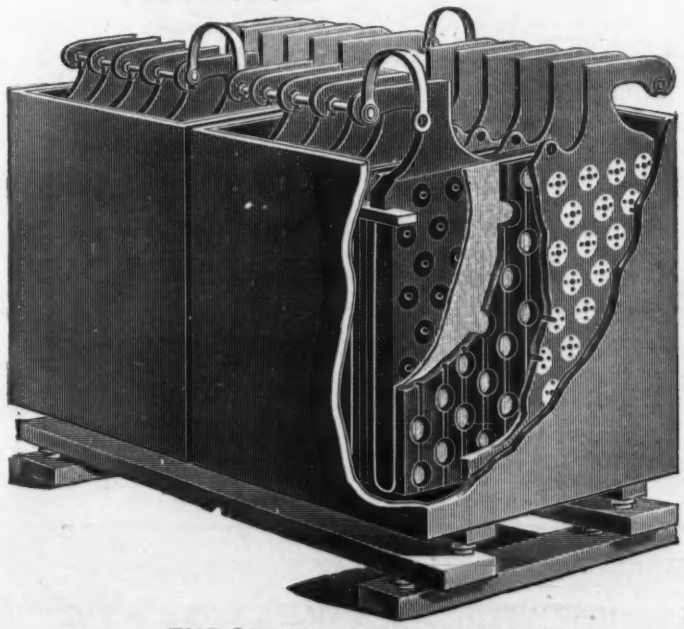

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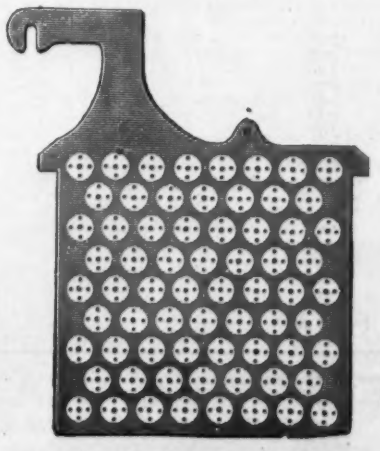

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***Annunciators.***
McDermid Mfg. Co.
Partrick & Carter Co.
Proctor-Raymond Electric Co.
Washington Electric Co.

***Armatures.***
Chesley Electric Co.
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Himmer, Vitalis.
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Leclanche Battery Co.
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Eastern Elec. Light & Stor. Bat. Co
Electric Storage Battery Co.
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Klipstein, A.
Law Battery Co.

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Proctor-Raymond Electric Co.
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Whiting Novelty Mfg. Co.

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Erie City Iron Works.
Harrison Safety Boiler Works.
Heine Safety Boiler Co.
National Water Tube Boiler Co.
Stirling Co.

***Boiler and Pipe Covering.***
Keasbey & Mattison Co.

***Braiding Machinery.***
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Berlin Iron Bridge Co.

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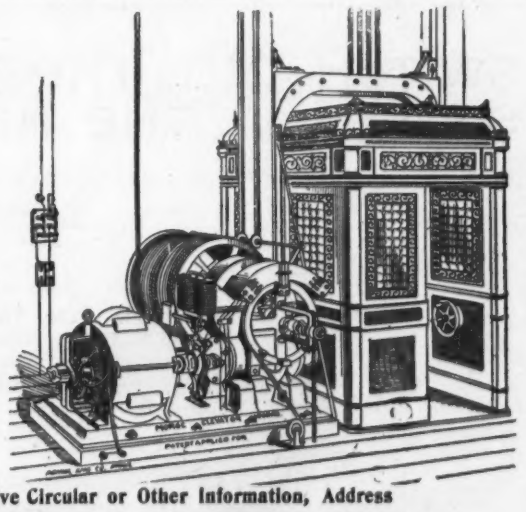

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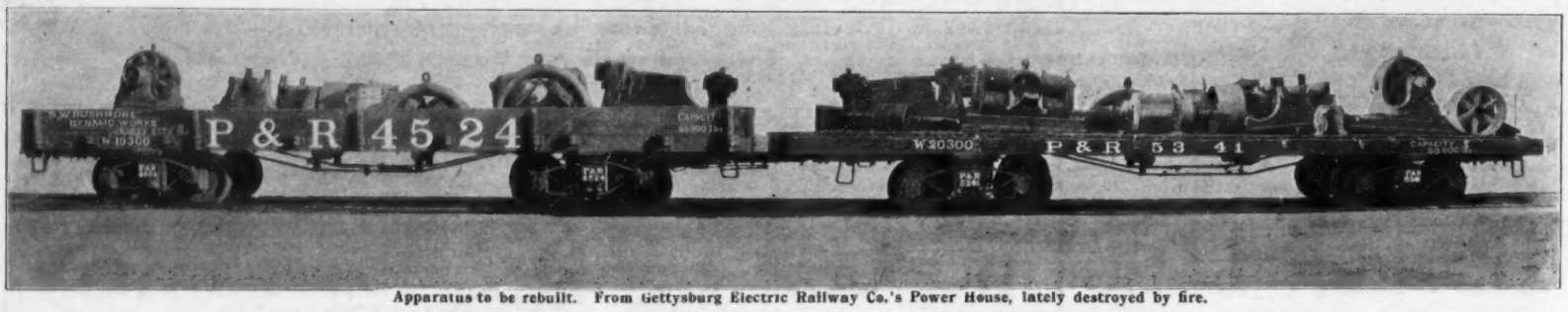


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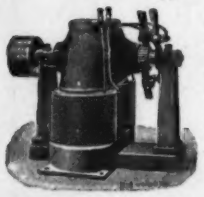

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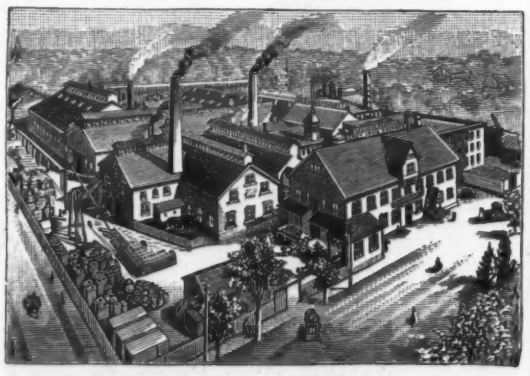

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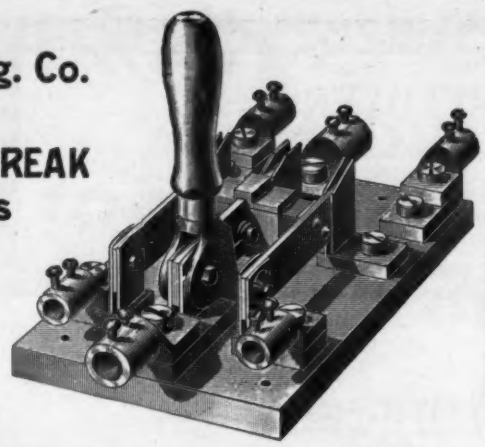

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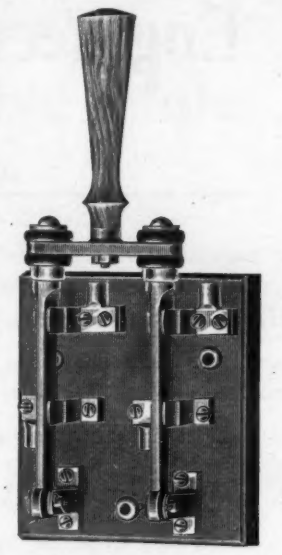

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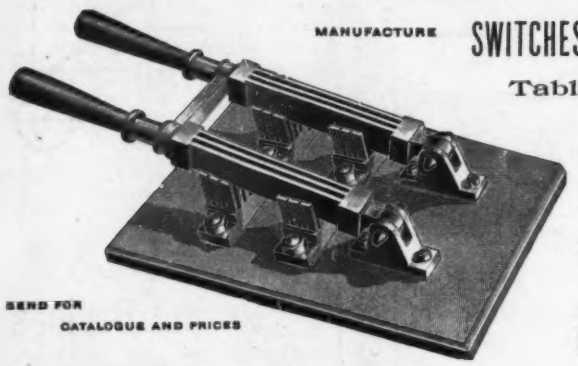

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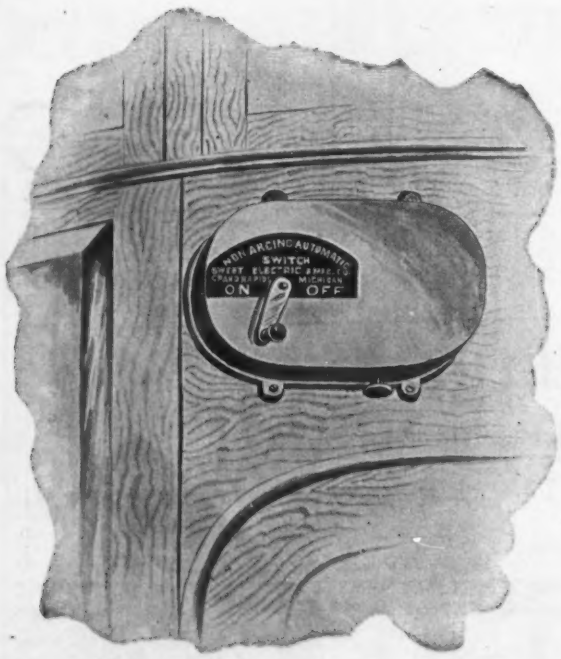


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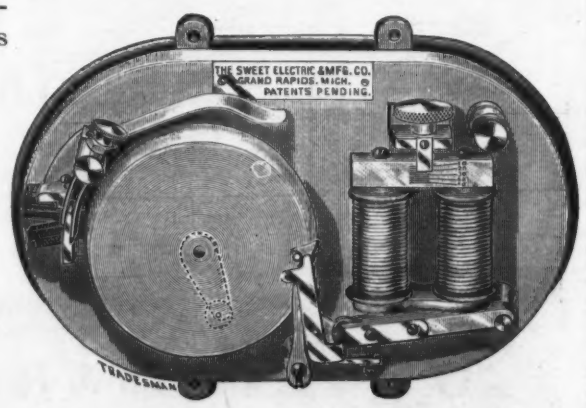


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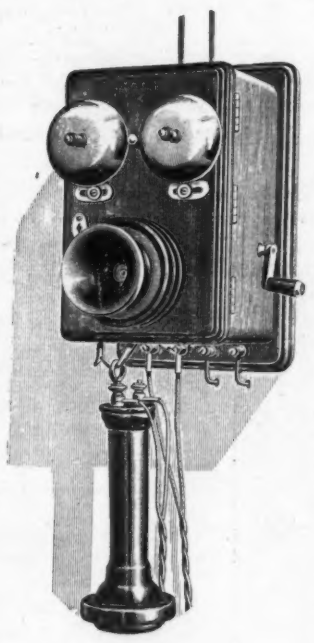

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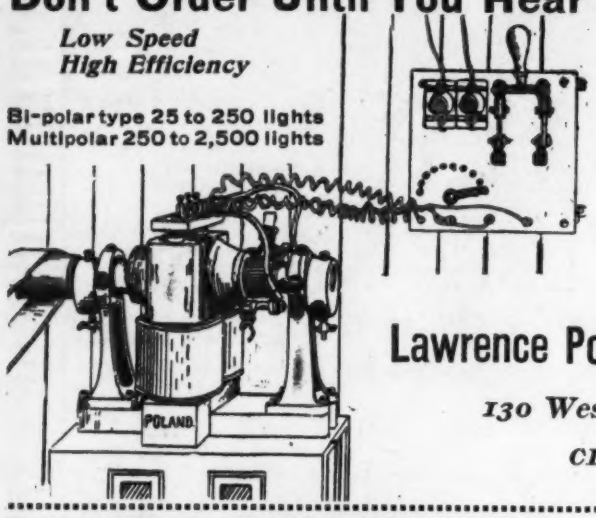


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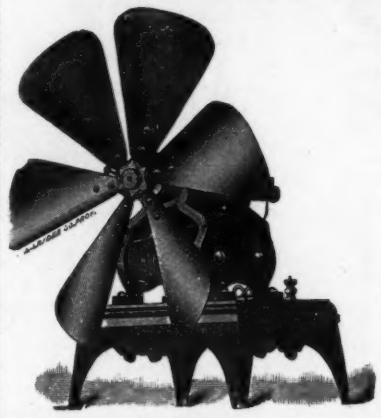

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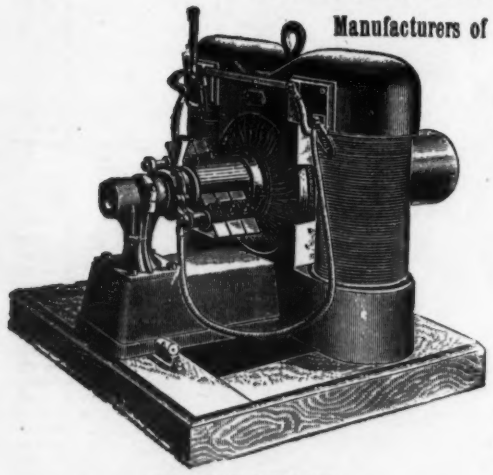

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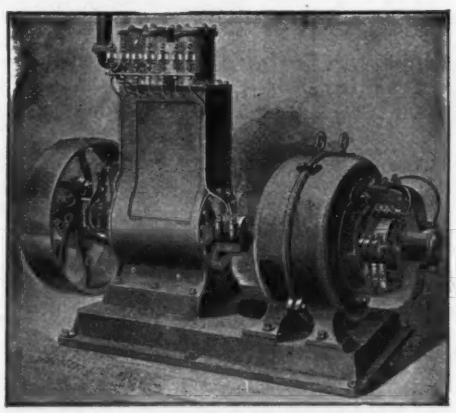

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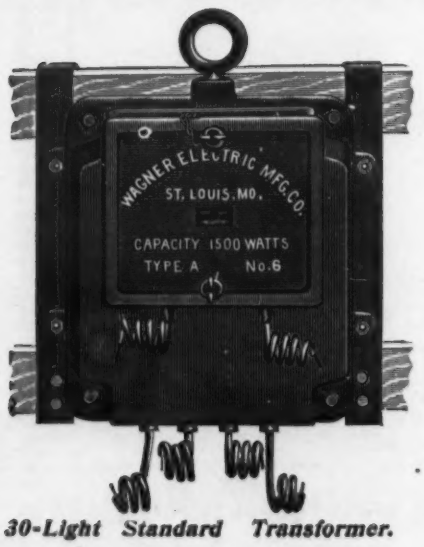


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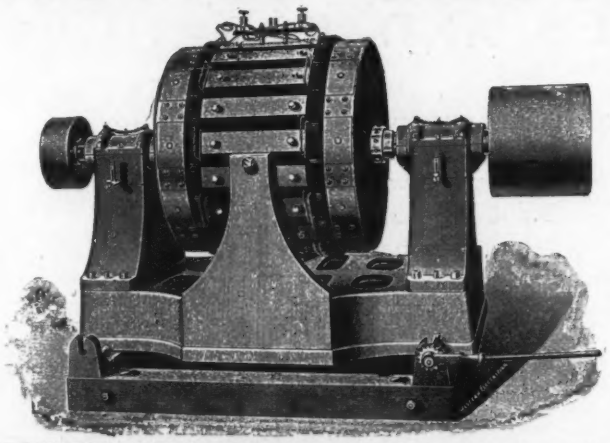

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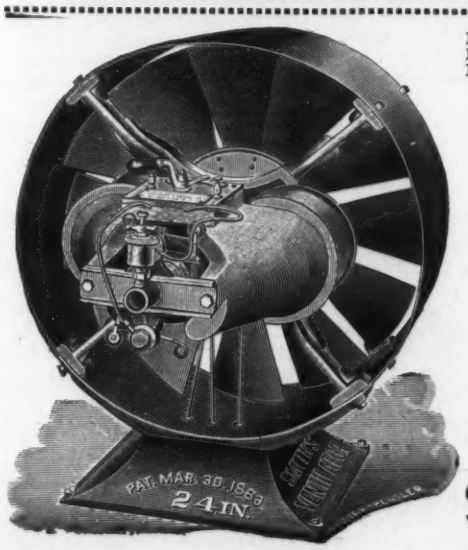


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AND

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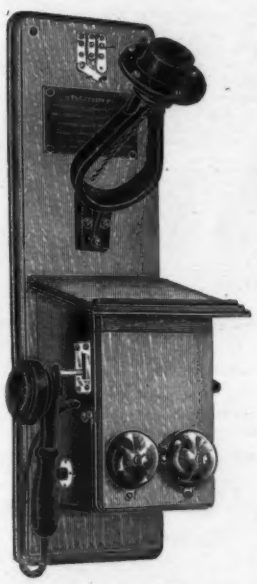

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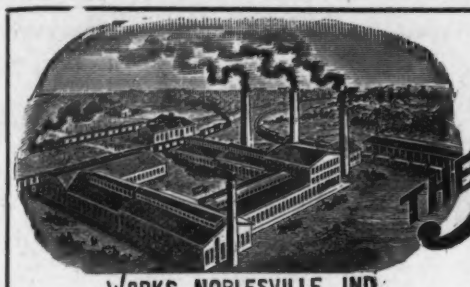


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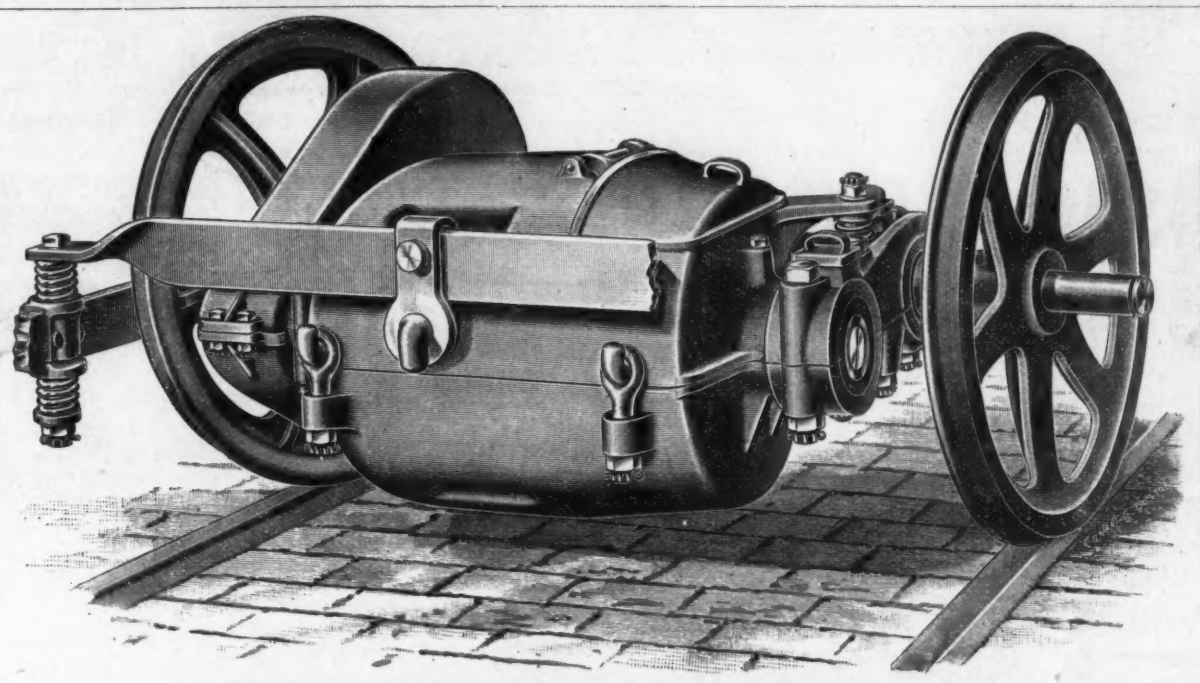

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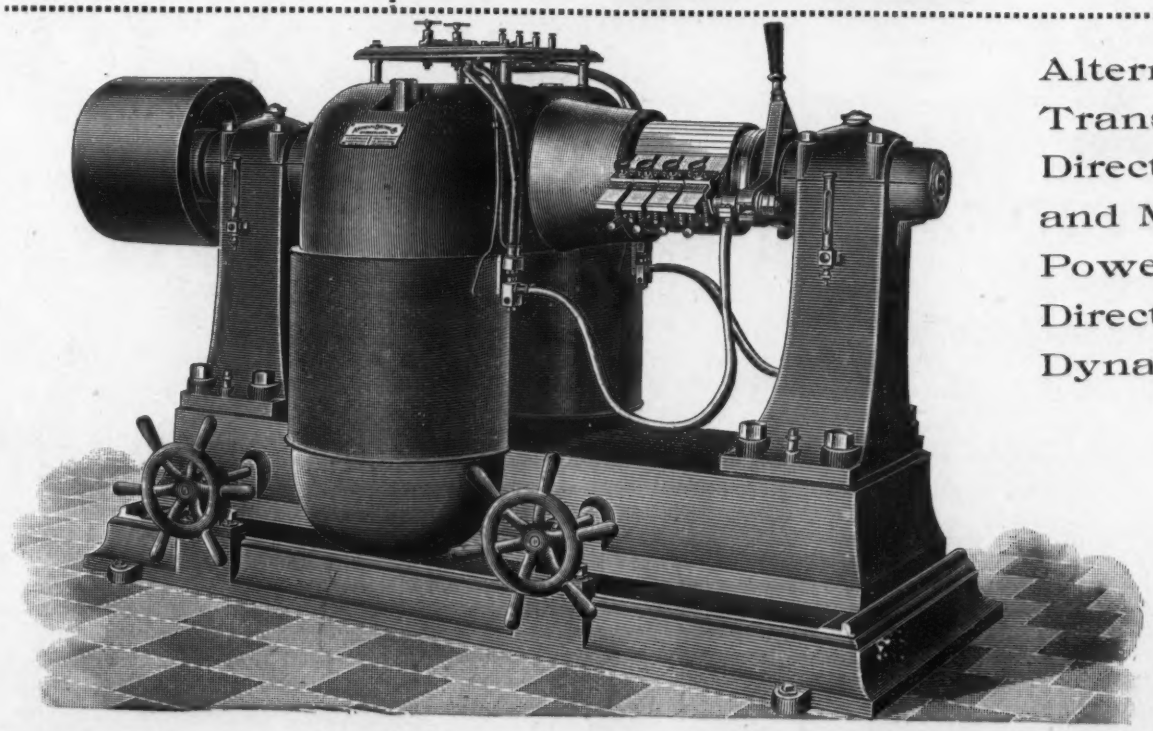

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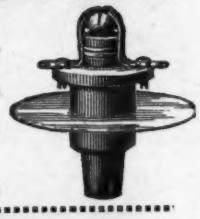

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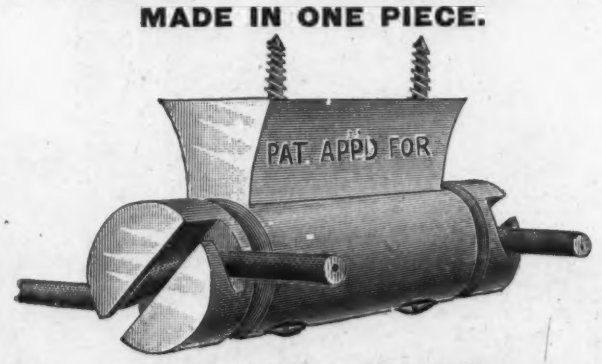


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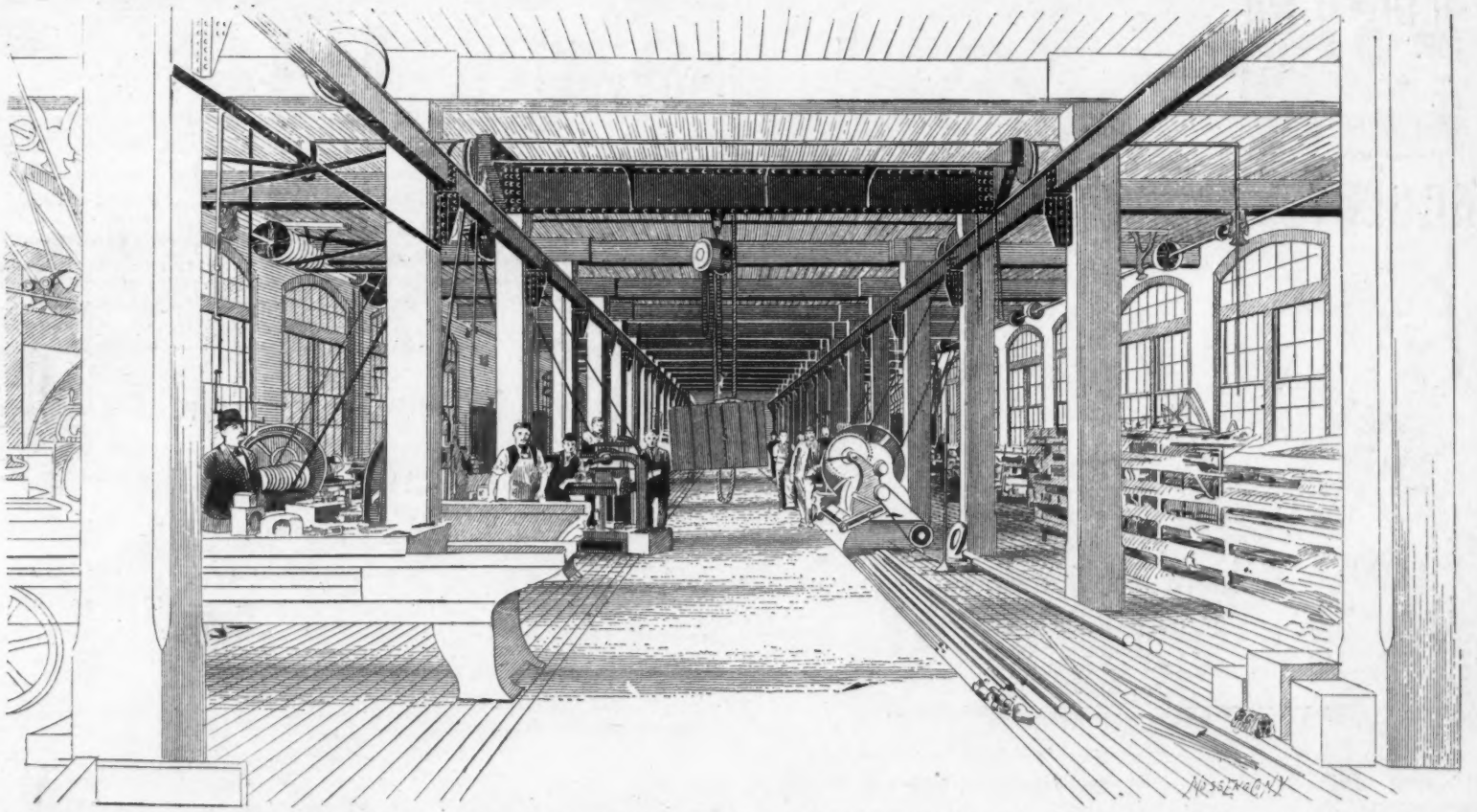

The above illustration is taken direct from a photograph and shows the construction of a Traveling Crane placed by us in the Machine Shop of the National Meter Company, at Brooklyn, N. Y. The building is the usual construction of brick walls with wooden posts, supporting wooden floors. The crane girders are attached to wooden posts and the crane has a travel the full length of the building between the posts. The plan commends itself where parties desire to control a limited floor space in a building already built.

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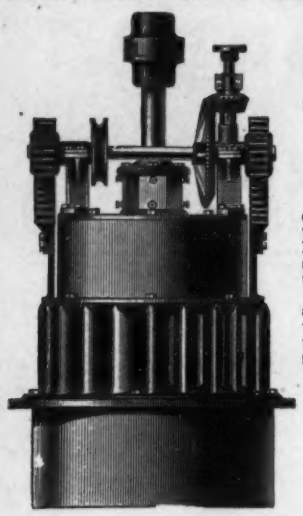

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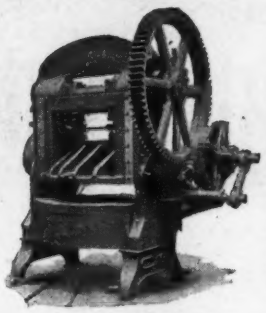

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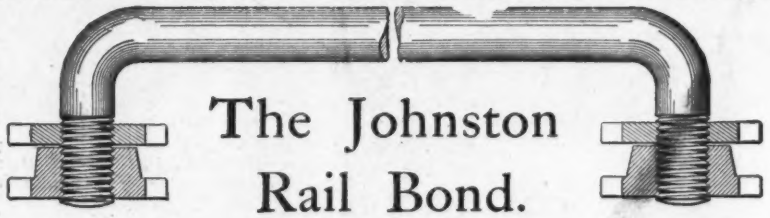

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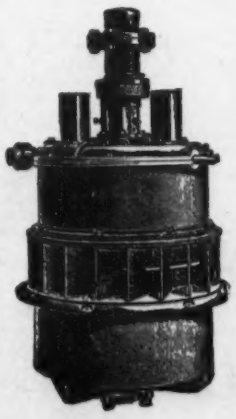

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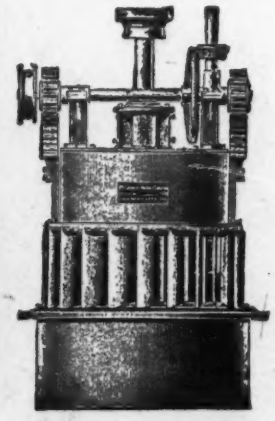

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That there are more Victor Turbines in use supplying Power for Electric Generators than any other is due to the many points of superiority possessed by this Turbine.

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**Great Capacity. . . .**

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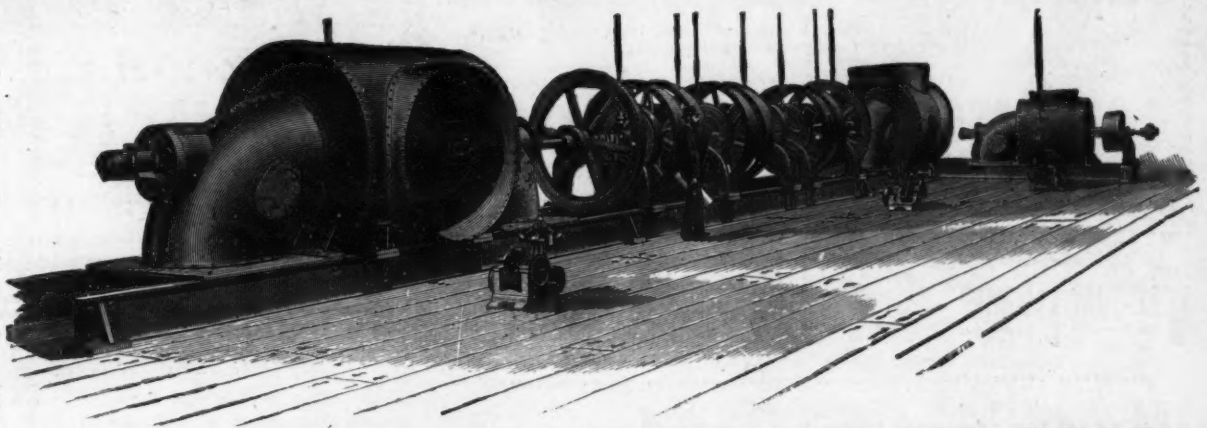
**Perfect Cylinder Gate.**

**Steady Motion. . . .**



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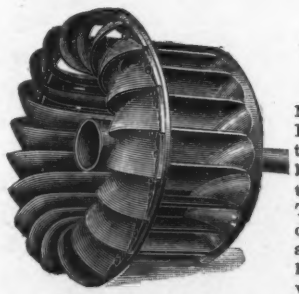

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It is a well-known fact that the Victor, Hercules and the McCormick have taken their cue from the construction of the Little Giant wheel. Some had paid for a shop-right to manufacture a wheel and use the Little Giant's patented parts; others have deliberately made use of said parts in the construction of their wheels without pay. We therefore make the assertion that The Little Giant is the ORIGINAL WHEEL, made from the patented designs, which has been used and has given to the above wheels all the useful efficiency they claim so much for. The Little Giant has all of them, and many more that make it the MOST POWERFUL WHEEL MADE, using less water and producing more speed and power than any other. We guarantee all we say for the wheel. With prices low we solicit your patronage. Send for catalogues with discounts.

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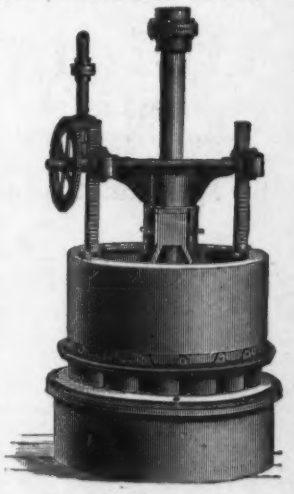
| 14½ in. | 18 ft. | 366 | 28.76 |
| 17½ " | 16 " | 283 | 29.78 |
| 20 " | 14 " | 232 | 34 24 |
| 23 " | 12 " | 187 | 35.66 |
| 27 " | 12 " | 162 | 54 29 |
| 31 " | 12 " | 138 | 62.00 |
| 36 " | 12 " | 121 | 83.86 |
| 40 " | 11 " | 108 | 89.25 |
| 44 " | 11 " | 94 | 107 10 |
| 48 " | 10 " | 82 | 118.22 |
| 54 " | 10 " | 72 | 110.58 |
| 60 " | 10 " | 64 | 153.26 |
| 66 " | 8 " | 53 | 132.30 |



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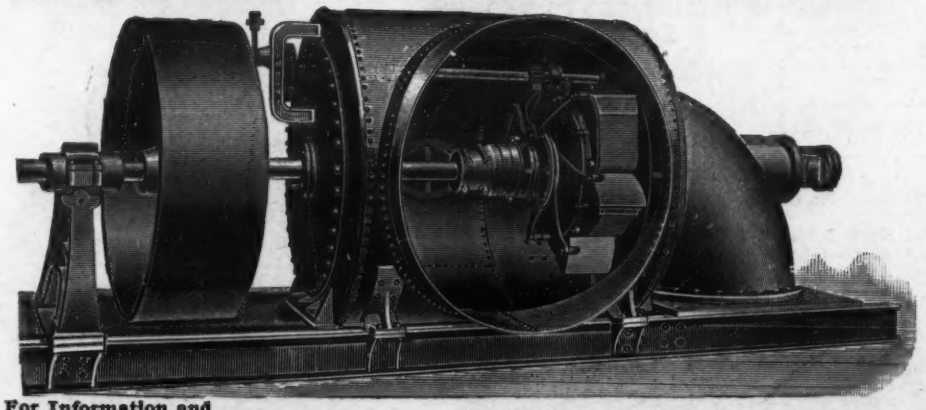

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|---|---|---|---|---|---|
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| ⅞ " ..... | 16.42 | 122.00 | 127.18 | 195.19 | 82.58 |
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| ½ " ..... | 16.88 | 118.67 | 82.07 | 180.40 | 75.52 |

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| | | | | | |
|---|---|---|---|---|---|
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| ⅞ " ..... | 16.56 | 134.80 | 120.85 | 188.14 | 83.09 |
| ¾ " ..... | 16.59 | 129.33 | 104.85 | 162.89 | 82.77 |
| ⅝ " ..... | 17.13 | 125.25 | 92.76 | 142.40 | 79.21 |
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The wire can easily be put in place or removed without loosening the Cleat.
It is a great saver in Time and Labor over any other Cleat in use for putting up Electric Light or other Wires.

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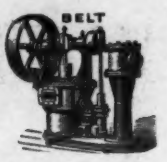


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Wire wound on a vulcabeston spool and insulated with a solid compound. All the advantages of an oil transformer without the grease and dirt . .
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**ALL VOLTAGES**
AS BUILT BY
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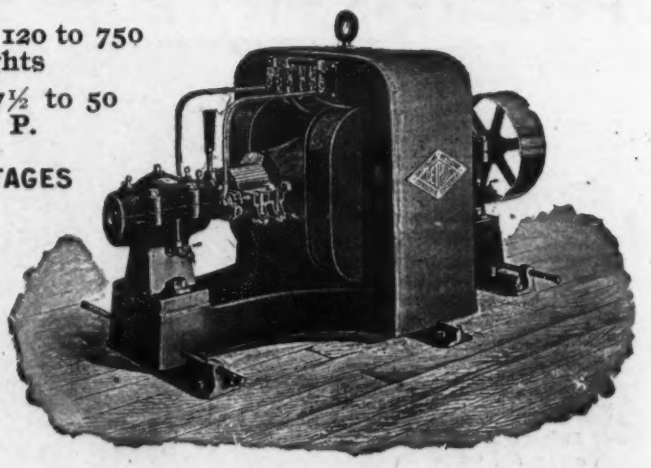

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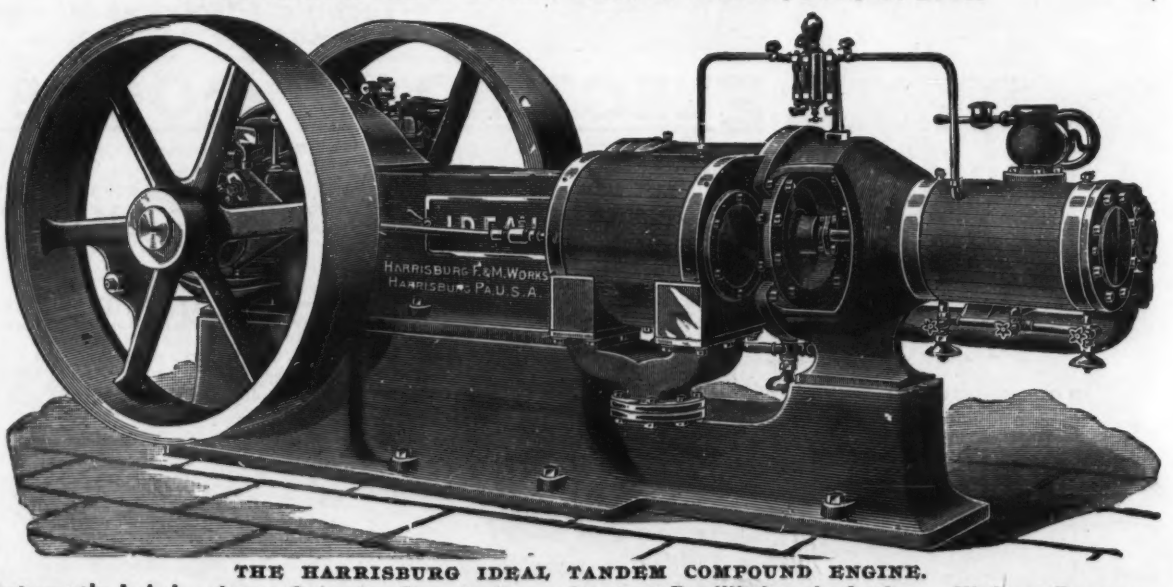


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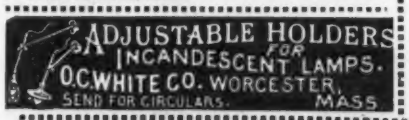


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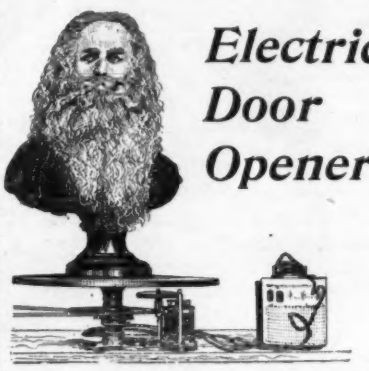

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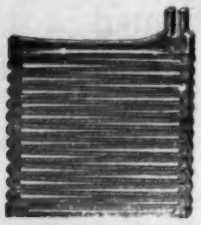
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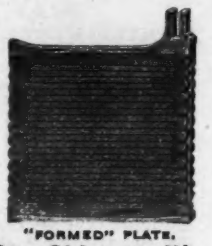
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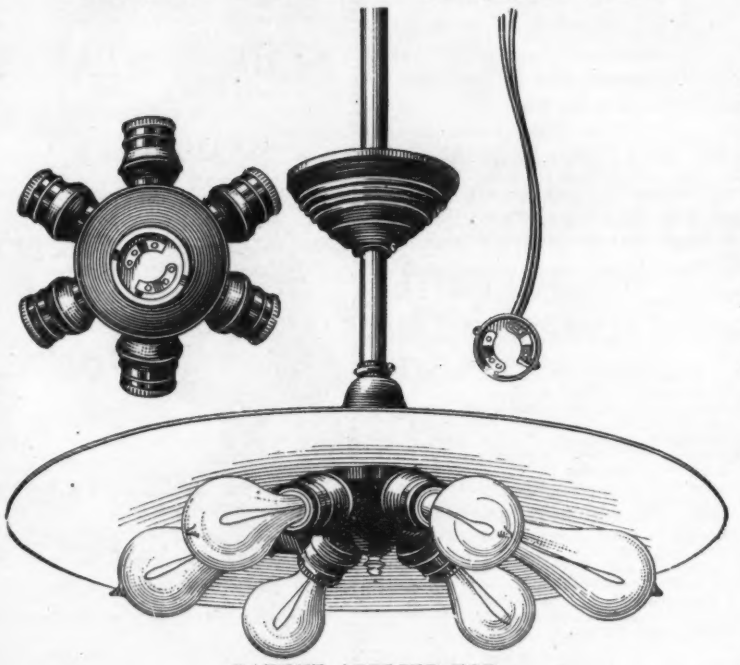

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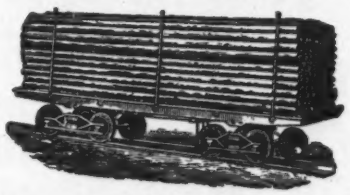

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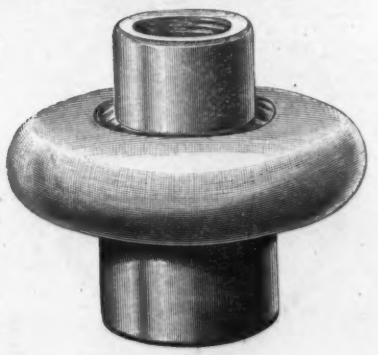

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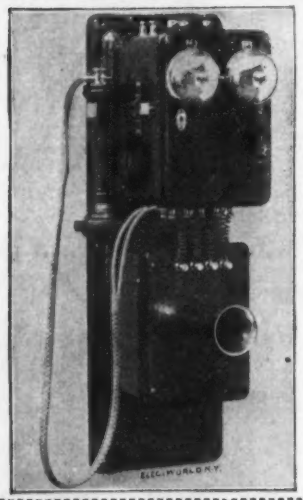

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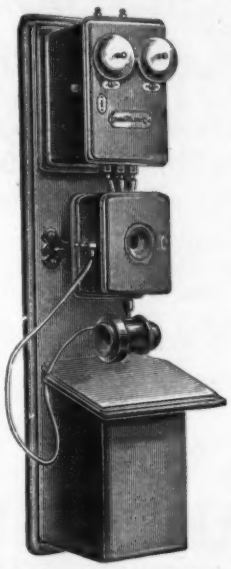

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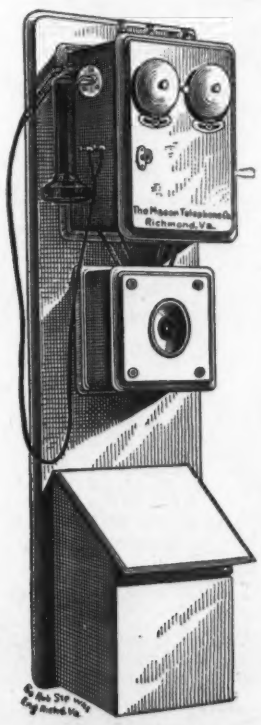


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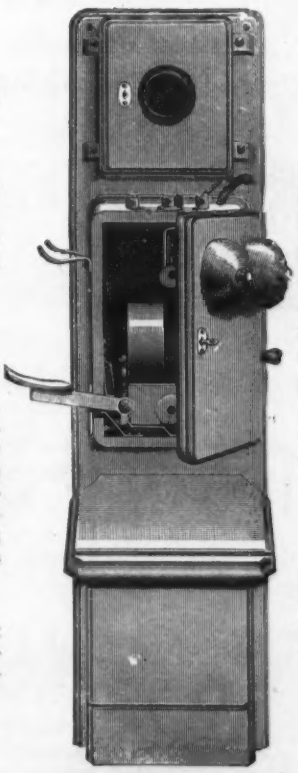

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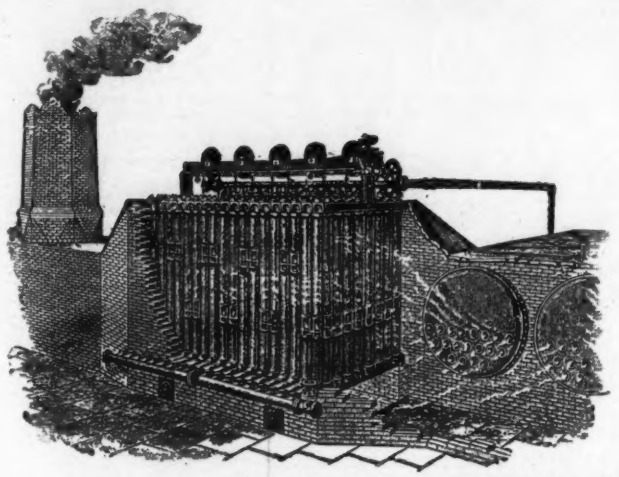

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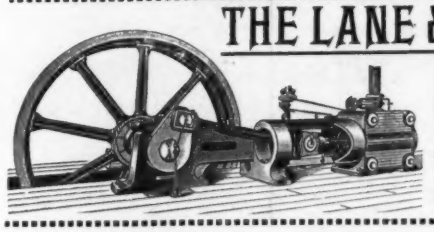

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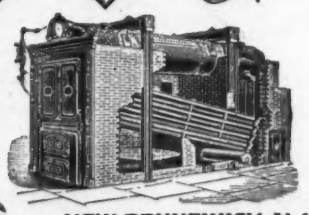

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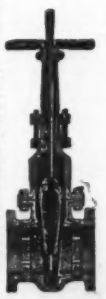

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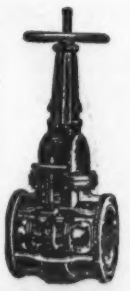

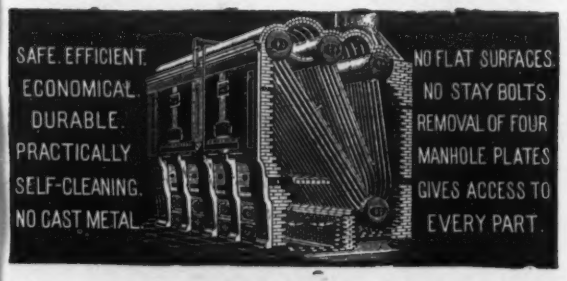


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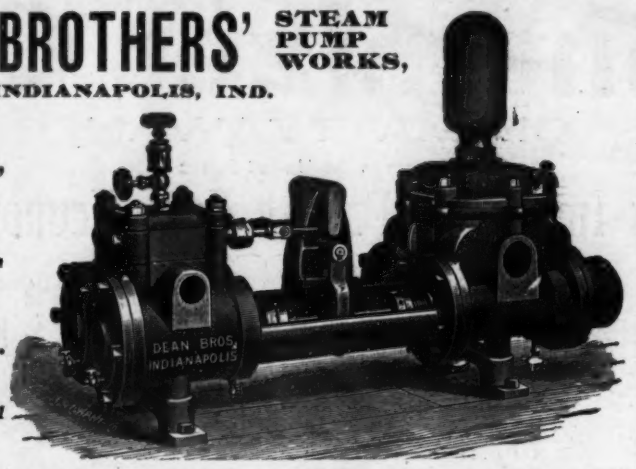


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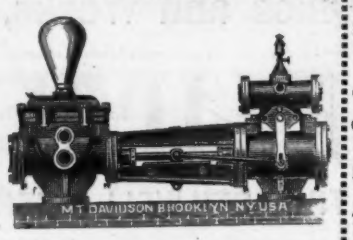


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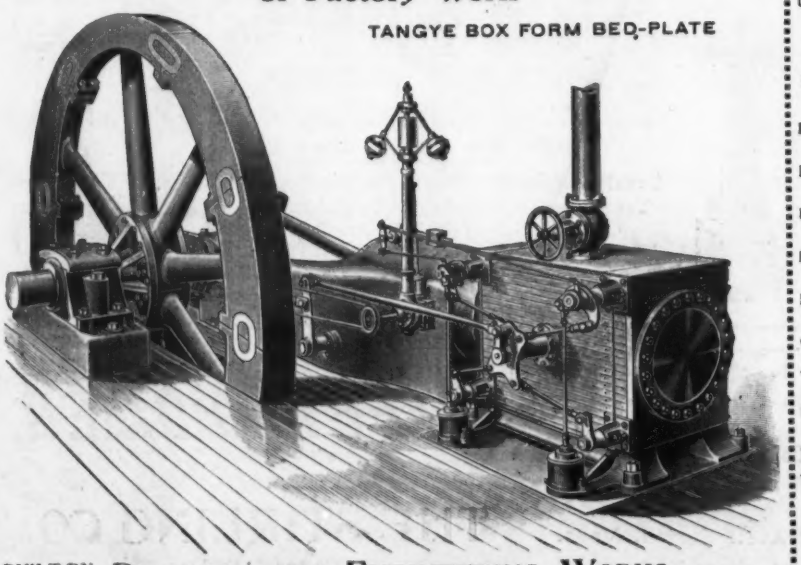

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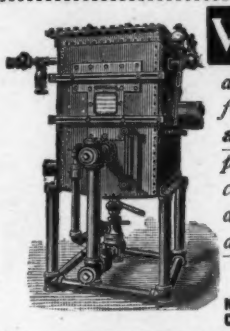

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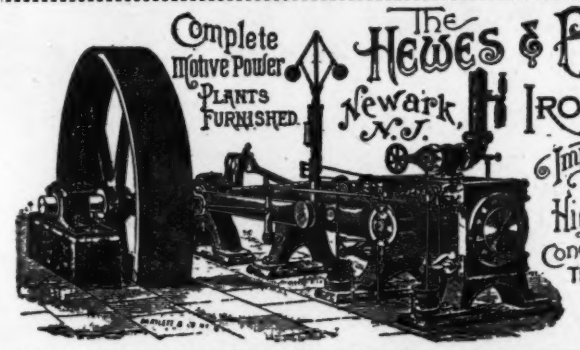


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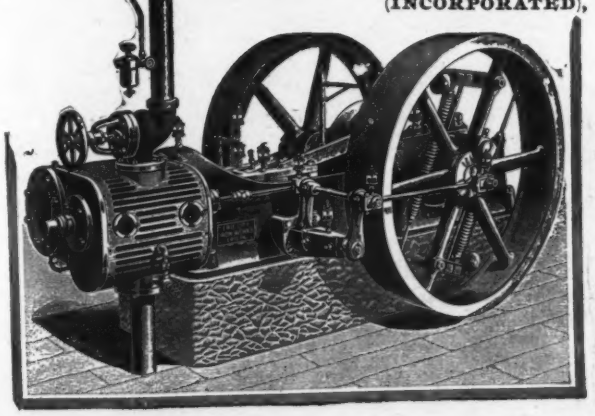

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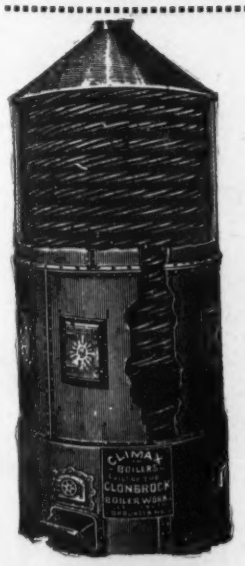


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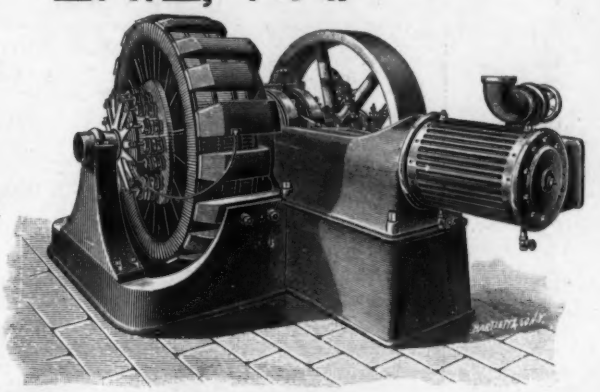

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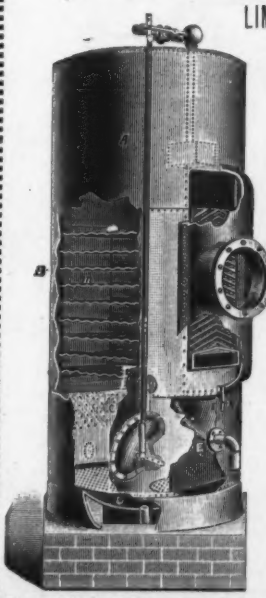

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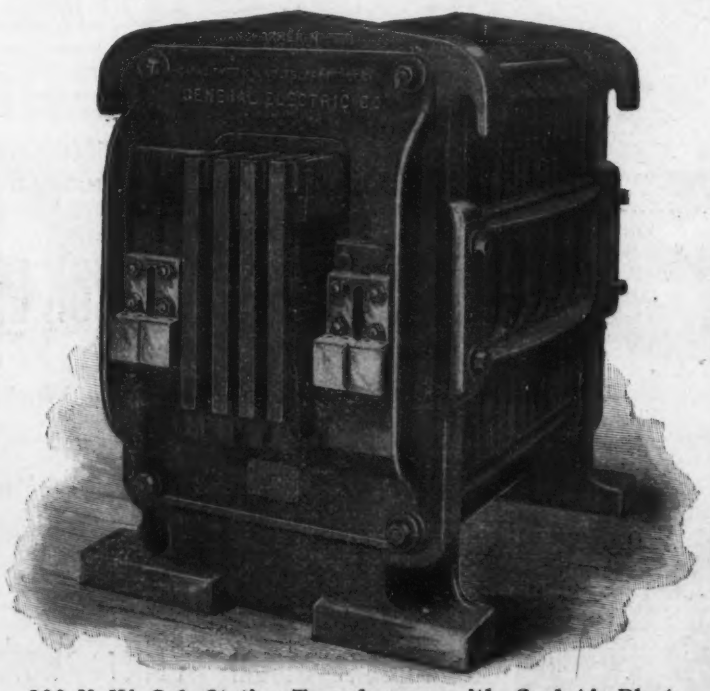

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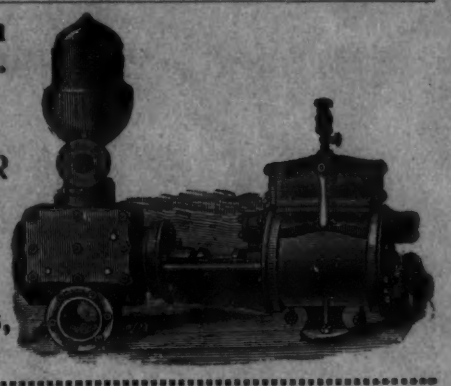

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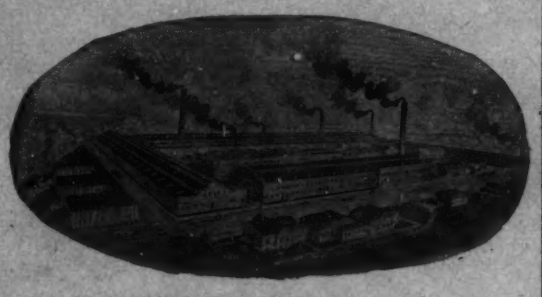

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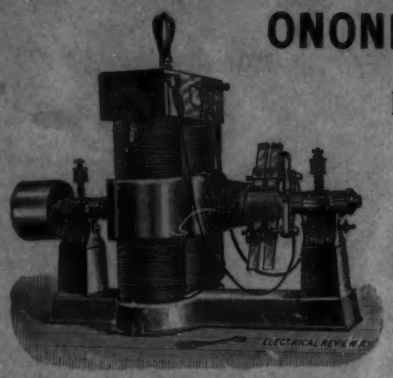

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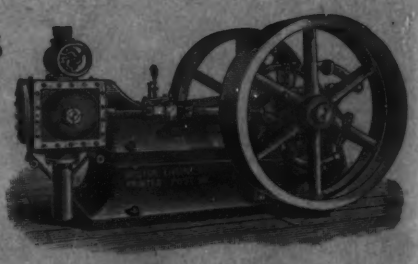

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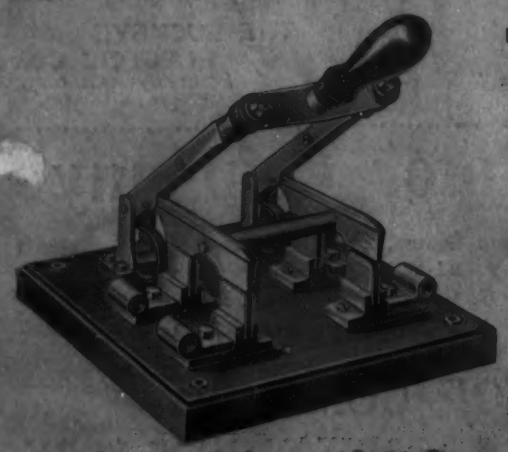

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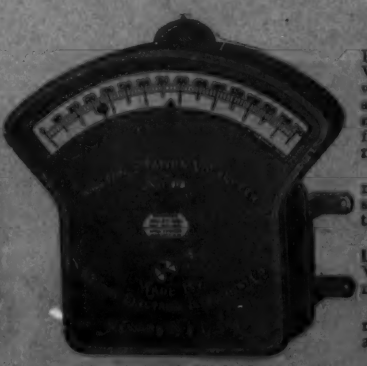

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